JUGOSLOVENSKO DRUŠTVO ZA RADIOLOŠKU ZAŠTITU

IV SIMPOZIJUM IZ RADIOLOŠKE ZAŠTITE

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Organizacioni odbor:

Panov dr Dušan, predsednik
Magarašević prof. dr Mileta
Kostijal prof. dr Krista
Novak prof. dr Josip
Ignjatović Slobodan, spec. n. fiz
Ristić Đorđe, dipl. ing.
Kristan dr Janez
Jokić doc. dr Jovan
Simić Bora, dipl. ing.
Stojanović dr Dragoslav
Sterle prof. Marjan
Deanović dr Živan

Sekretarijat:

Radovanović Radoslav, dipl. fiz.
Novak mr. ph. Ljiljana
Jeremić dr Miodrag

Tehnička organizacija

Institut za medicinu rada i radiološku zaštitu »Dr Dragomir Karajović« — Beograd

PROBLEMI ZAŠTITE PRI PRIMENI JONIZUJUĆIH ZRAČENJA U MEDICINSKE I INDUSTRIJSKE SVRHE

Jokić J., Žarković G., Panov D., Kilibarda M.

Institut za higijenu i socijalnu zaštitu — Sarajevo

Institut za medicinu rada i radiološku zaštitu »Dr Dragomir Karajović« Beograd

Najbrojniji vještački izvori jonizujućeg zračenja se nalaze u medicinskim ustanovama.

Pored prirodnog zračenja, medicinska primjena jonizacije daje za sada najveći doprinos populacionoj primljenoj dozi.

Izlaganje stanovništva jonizujućem zračenju u toku medicinske primjene proizilazi iz:

a) upotrebe »X« zraka u dijagnostičke svrhe,

b) upotrebe radioizotopa u dijagnostičke svrhe,

c) upotrebe »X« zraka i drugih izvora u terapeutske svrhe.

Od svih izvora primenjivanih u medicini daleko su najbrojniji rendgen aparati.

Procjenjuje se da »X« zraci upotrebljeni u dijagnostičke svrhe daju 70—90% cjelokupne doze stanovništva.

U mnogim zemljama se svaki drugi, a u nekim skoro svaki stanovnik prosječno jedanput godišnje podvrgne nekom od medicinskih radioloških postupaka.

Upotreba jonizujućeg zračenja je neophodna u savremenoj medicini i sa razvojem medicine postaje sve šira i raznovrsnija. To ima za posledicu povećanje ne samo individualne nego i populacione doze apsorbovanog zračenja.

Postoje brojni naučni dokazi da apsorpcija i malih doza zračenja kakve se sreću u većini medicinskih radioloških postupaka može dovesti do neželjenih somatskih i genetskih posledica kod ozračenih lica, odnosno njihovih potomaka.

Primjenom medicinske radiologije društvo svjesno prihvata rizik i procjenjuje ga u odnosu na korist od te primjene.

Da bi rizik bio što manji, a korist od upotrebe jonizujućeg zračenja u medicini što veća, potrebno je pridržavati se ovih glavnih principa:

1. Radiološki postupak vršiti samo ako postoji jasna medicinska indikacija;

2. Ako je radiološki postupak neophodan, onda ga treba obaviti kvalifikovano lice, na ispravnom izvoru zračenja, uz dobru tehniku rada i ostale zaštitne mjere da bi se što manje ozračio pacijent, a i lice koje rukuje izvorom.

Poslednjih 15 godina industrijskog razvoja u našoj zemlji primena jonizujućeg zračenja u industriji zauzima značajno mesto, ali ona nije još dostigla onu širinu i dala svoj doprinos industriji kao što je to slučaj pri njihovoj primeni u biološkim granama nauke.

U radu se iznose osnovni problemi koji se javljaju pri primeni jonizujućih zračenja zaštite u industriji. Na osnovu podataka republičkih centara za zaštitu u Jugoslaviji danas postoje više od 110 laboratorija u preduzećima koja primenjuju jonizujuća zračenja.

U ovim laboratorijama primenjuje se oko 230 zatvorenih i otvorenih izvora zračenja aktivnosti od oko 700 Ci.

PROBLEMS OF PROTECTION AT APPLICATION OF IONIZING RADIATIONSIN MEDICAL AND INDUSTRIAL PURPOSES

Jokić J., Žarković G., Panov D., Kilibarda M.

Institute of Hygiene and Social Medicine of Sarajevo
Institute of Occupational and Radiological Health »Dr Dragomir Karajović« Beograd

The largest number of artificial sources of ionizing radiations is situated in medical institutions.

In addition to background radiation the medical use of ionization contributes for the time being in the largest measure to the doses received by the population.

The exposure to ionizing radiation of the population in the course of their medical application comes from:

a) the use of X-rays for diagnostic purposes,

b) the use of radioisotopes for diagnostic purposes,
c) the use of X-rays and other sources for therepeutic purposes.

Of all the sources used in medicine the most numerous are the roentgen apparatuses.

It has been estimated that the X-rays used for diagnostic purposes are responsible for 70—90% of the total doses received by the population.

In some countries every second an in others almost every inhabitant is in the average once a year subjected to any of the radiological medical procedures.

The use of ionizing radiation is indispensable in modern medicine, and with the further progress of medicine it becomes the more widespread and manyfold. As a consequence there is an increase not only in the individual but also in the population dose of absorbed radiation.

There is numerous scientific evidence that the absorption of even small doses of radiation, as met in most of the medical radiological procedures, may result in undesired somatic and genetic damages in the persons exposed or their descendants.

With the use of medical radiology society consciously accepts the risk and evaluates it against the benefits of his application.

To lessen the risks involved and enlarge the benefits of the use of ionizing radiations in medicine it is necessary to adher to these major principles:

1. To apply radiological procedures only in cases of strict medical indications;

2. If radiological procedures are indispensable they must be applied by qualified persons, with a perfectly functioning source of radiation and proper techniques of work, and the use of other protective measures in order to expose the patient as little as possible, as well as the person operating the source.

Last fifteen years of industrial development in our country application of ionizing radiation in industry takes a significant place, but this applacation has not achieved a scale and not given its contribution to the industry as it is a case at its application in beological sciences.

In this paper the fundamental problems of the protection which appear at application of ionizing radiation in industry are given. According to the data of Republic Centers for protection in Yugoslavia today exist more than

llo laboratories in enterprises applying ionizing radiation. In these laboratories about 230 closed and open sources of radiation activity of about 700 Ci are applied.

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STRUČNA SPREMA MEDICINSKOG OSOBLJA NA RADU SA DIJAGNOSTIČKIM RENDGEN APARATIMA

Magarašević M., Ojdanić Z.

Rendgenološko odeljenje Gradske bolnice Beograd

Autori daju podatke o broju lekara u SFRJ koji se bave pojedinim oblastima rendgendijagnostike, a nisu dopunski osposobljeni za rad sa x-zracima. Izlažu svoja opažanja i merenja najvažnijih parametara koji ulaze u kalkulacije iradiacionih doza i diskutuju o nepovoljnim reperkusijama rada lekara ne-radiologa na sve iradiacione doze. U tom kontekstu ističu značaj i nedovoljne stručne spreme srednjeg kadra.

Predlažu da se lekari, koji u okviru svojih specijalnosti primenjuju pojedine rendgendijagnostičke metode, osposobe za rad sa rendgen-aparatima u cilju sovpstvene zaštite i zaštite pacijenata.

THE VOCATIONAL QUALIFICATION OF MEDICAL STAFF AT WORK WITH DIAGNOSTIC X-RAYS UNITS

Magarašević M., Ojdanić Z.

City Hospital — Beograd

Autors present data about a number of physicians in Yugoslavia engaged in some fields of roentgen-diagnostics, but not qualified for the work with the x-rays. They point out their observations and measurements of the most important parameters included into calculation of irradiation doses. They also discuss unfavourable effects of all irradiation doses on those physicians who are not radio-

logists. Further, the authors emphasize insufficient vocational qualification of the technical staff.

The authors suggest that all the physicians, who use some roentgen-diagnostic methods in their everyday practice, should be qualified for the work with x-rays units in order to protect themselves and their patients.

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ŠKOLOVANJE KADROVA ZA RAD SA IZVORIMA JONIZUJUĆEG ZRAČENJA

Đurić G., Melovski Lj.

Institut za nuklearne nauke »Boris Kidrič«
Beograd

U radu se iznosi:

— obuka kadrova na osnovnim i specijalističkim kursevima u Odeljenju za obuku kadrova, Instituta za nuklearne nauke »Boris Kidrič«, za rad sa izvorima jonizujućeg zračenja;

— mogućnosti školovanja kadrova zaduženih za zaštitu od jonizujućih zračenja pri industrijskoj i medicinskoj primeni izvora jonizujućih zračenja;

— pregled obuke kadrova u industrijski razvijenim zemljama, potrebe i uslovi za takvo školovanje u našoj zemlji.

TRAINING OF PERSONNEL IN HANDLING RADIOACTIVE MATERIALS, AND IN RADIOLOGICAL PROTECTION

Đurić D., Melovski Lj.

The Boris Kidrich Institute of Nuclear Science, Belgrade,

The paper describes the activities of the Department for Training of Personnel Handling Radioactive Materials of the Boris Kidrich Institute of Nuclear Sciences which

organises Basic and Speciality courses for Training of Personnel in charge of protection against ionizing radiations. A review is given of similar Training courses in some industrially developed countries. The need for further development of this activity in our country is stressed and necessary conditions pointed out.

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NAUČNO-TEHNIČKE INFORMACIJE I RADIOLOŠKA ZAŠTITA

Jevremović-Vladiković V.
Institut za naučno-tehničku dokumentaciju
i informacije

U oblasti radiološke zaštite, kao i u mnogim oblastima nauke i tehnike, postoji neophodnost za pravovremeno dobijanje brze, egzaktne i dovoljno potpune informacije. Od niza faktora koji određuju informacione potrebe korisnika informacija u ovoj širokoj oblasti najvažniji su sledeći: brzi kvantitativni porast naučno-tehničke literature, ubrzanje procesa primene naučno-tehničkih otkrića, povećanje broja interdisciplinarnih problema, diferencijacija nauke, porast broja naučno-tehničkog kadra, kao i nesavršenost sistema za traženje informacija. Pitanja: ko, kako i kada zadovoljava informacione potrebe naučnika i stručnjaka treba da se reše kroz stvaranje savremenog informacionog sistema. Biće data dosadašnja iskustva Instituta za naučno-tehničku dokumentaciju i informacije iz odnosa: informacije — radiološka zaštita.

SCIENTIFIC-TECHNICAL INFORMATIONS AND THE RADIOLOGICAL PROTECTION

Jevremović-Vladiković V.

Institute of scientific-technical documentation
and information, Beograd

In the field of radiological protection, like in many other fields of science and technology, it is important to

get timely good, exact and complete informations. Among many factors that determine the need for informations of the user in this wide field, the most important are: the appearance of a great number of scientific-technical literature, the acceleration of the scientific-technical discoveries application, the differentiation of science, the increasing number of the scientific-technical staff, as well as the unperfectness of the information retrieval systems. The questions: who, how and when suffices the need for informations of scientists and specialists, have to be solved through the creation of a modern informational system. In this paper the information collecting activity of the Institute of scientific-technical documentation and information in the field of radiological protection is given.

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OBAVEZE I ZADACI ZDRAVSTVENE I SANITETSKE SLUŽBE U SPROVOĐENJU MERA MEDICINSKE RADIOLOŠKE ZASTITE U VANREDNIM USLOVIMA

Pejušković B.

Higijenski zavod VMA Beograd

U vanrednim situacijama, pri primeni nuklearnih borbenih sredstava veliki deo obaveza iz radiološke zaštite pada na teret zdravstvene i sanitetske službe. Efikasne mere medicinske radiološke zaštite mogu se sprovesti samo zajedničkom saradnjom, usvojenom jedinstvenom doktrinom u pogledu metoda rada, instrumentacije, dozvoljenih doza i nivoa kontaminacije u vanrednim stanjima i drugim merama zaštite, između ove dve službe.

Zajedničke obaveze ostvaruju se kroz integrisanu saradnju na detekciji, identifikaciji R-agenasa u vodi, hrani i drugim sredinama. Neophodnost saradnje još u miru na usvajanju i obezbeđenju opreme (instrumentacije), usvajanju maksimalno dozvoljenih doza i nivoa kontaminacije

(voda, hrana) i dr. Organizacija i obaveze laboratorijske službe i službe dekontaminacije. Posebno, saradnja se treba ostvariti na jedinstvenom sagledavanju radijacione povrede, prevenciji i zbrinjavanju povređenih, počev od prve pomoći do rehabilitacije, kako bi se poboljšao efekat lečenja a time brže vraćanje radne i borbene sposobnosti povređenih (ozračenih).

OBLIGATIONS AND DUTIES OF THE SANITARY AND ARMY HEALTH SERVICES PUTING MEDICAL RADIOLOGICAL MEASURES TO EFFECT IN EMERGENCIES

Pejušković B.

Hygienic Institute VMA Beograd

In emergencies when nuclear device have been used a lot of obligations of radiological protection must be borne by sanitary and Army health servicies. Effective measures of radiological protection may be put to effect only by joint cooperation, adopted uniform doctrine as regards operation methods, instruments, allowed doses and levels of contamination in emergencies and other measures of protection, between this two servicies.

Joint obligations are realized by way of the integrated cooperation as regards the detection, the identification of the R agents in Water, Food and other environments. The necessity of cooperation even in piece time as regads the adaptation and securing of equipment adaptation of maximum permissible doses and the levels of contamination. The organisation and duties of laboratory services and the decontamination service. The cooperation should be especially realized as for the uniform attitude of the radiation injury, prevention and care for the injured, beginning from the first aid to rehabilitation, so that the effect of treatment could be improved, at the same time faster recovery of the working and fighting ability of the injured.

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ŠKOLOVANJE SREDNJIH MEDICINSKIH KADROVA ZA RAD U MEDICINSKIM RÖNTGEN KABINETIMA

Rosić S., Todorović S.

Rentgen odeljenje Opšte bolnice u Tuzli

APSTRAKT NIJE DOSTAVLJEN

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KONTAMINACIJA ALUMINIJUMA SA Co^{60} U VODENIM RASTVORIMA

Zarić M., Jelić Lj., Matijašić A.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Ispitivan je uticaj koncentracije kobalta kao i pH rastvora na kontaminaciju aluminijuma, pod određenim uslovima.

Kontaminacija aluminijuma je proporcionalna koncentraciji kobalta i verovatno se depozicija kobalta na aluminijumu vrši po Henrijevom zakonu, ali samo do pH 9.

Uticaj pH vrednosti na kontaminaciju je bitan. Sa povećanjem pH od 3—9, povećava se kontaminacija u svim slučajevima. Iznad pH 9, dolazi do opadanja količine deponovanog kobalta.

Dobijeni rezultati pokazuju da su procesi ili procesi kontaminacije aluminijuma vrlo kompleksni.

CONTAMINATION OF ALUMINIUM WITH Co^{60} AQUEOUS SOLUTIONS

Zarić M., Jelić Lj., Matijašić A.

»Boris Kidrich« Institute of Nuclear Sciences — Vinča

The effect of cobalt concentration and pH of the solutions on the contamination of aluminium, under given conditions has been studied.

The contamination of aluminium was proportional to the cobalt concentration and the deposition of cobalt on aluminium probably is carried under the Henry's low, but to pH 9 only.

The effect of pH on the contamination was essential. An increase in pH from 3 to 9, in all cases, results in an increase in the contamination. Above pH 9, the amount of cobalt deposited drops again to a low value.

The results obtained showed that the aluminium contamination process or processes are very complex.

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DEKONTAMINACIJA ALUMINIJUMA, NERĐAJUĆEG ČELIKA I SPREGA ALUMINIJUM-NERĐAJUĆI ČELIK U NEKIM RASTVORIMA ZA DEKONTAMINACIJU

Jelić Lj., Zarić M., Stojanović B., Matijašić A.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Izvršeno je ispitivanje dekontaminacije aluminijuma, nerđajućeg čelika i kontakta aluminijum-nerđajući čelik, kontaminiranih sa Co^{60}, u sledećim rastvorima za dekontaminaciju: hrom-fosfornoj kiselini (2% + 7%) diamonijumcitratu (5%), tri-amonijumcitratu (5%), tetra-natrijum soli EDTA (1%).

Kod dekontaminacije samog aluminijuma i nerđajućeg čelika, dobijeni su visoki faktori dekontaminacije u hrom-fosfornoj kiselini, di- i tri-amonijumcitratu. U rastvorima tetra-natrijumove soli EDTA faktori dekontaminacije su niski, izuzev za nerđajući čelik na 60°C.

Faktori dekontaminacije kod aluminijuma i nerđajućeg čelika u međusobnom kontaktu, po pravilu su niži nego kod samih metala. Najveće smanjenje faktora dekontaminacije registrovano je kod sistema aluminijum-nerđajući čelik hrom-fosforna kiselina.

DECONTAMINATION OF ALUMINIUM, STAINLESS STEEL AND THE ALUMINIUM-STAINLESS STEEL COUPLE

Zarić M., Jelić Lj., Matijašić Lj., Stojanović B.

»Boris Kidrič« Institute of Nuclear Seiences, Vinča

Decontamination of aluminium, stainless steel and the aluminium-stainless steel couple, contaminated with Co^{60} was studied. The solutions used for the decontamination were: chromic-phosphoric acid (2 Wt% + 7 Wt%) mixture, di-ammonium citrate (5 Wt%), tri-amonium citrate (5 Wt%) and the tetra-sodium salt of EDTA (1 Wt%).

High decontamination factors for aluminium and stainless steel were found in the solutions of chromic--phosphoric acid, di-ad tri-ammonium citrate. In the solution of the tetra sodium salt of EDTA, the decontamination factors were low, except for stainless steel at 60°C.

In the case of the aluminium-stainless steel couples, the decontamination factors obtained, were lower than at the decontamination of the metals without contacts. The most pronounced decrease of the decontamination factors was observed in the system aluminium-stainless steelchromic-phosphoric acid mixture.

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KONTAMINABILNOST GUMIRANIH PLATNA I NJIHOVA RADIOLOŠKA DEKONTAMINACIJA

Ristić M.

Institut za tehničko-medicinsku zaštitu — Beograd

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U radu su izloženi rezultati ispitivanja stepena dekontaminacije i mogućnosti radiološke dekontaminacije gumiranih platna, materijala, koji se upotrebljavaju za izradu rezervoara za deponovanje čiste vode. Materijali su kontaminirani vodenim rastvorima izotopa ^{131}J, ^{89}Sr i ^{144}Ce + + ^{144}Pr. Dekontaminacioni opiti vršeni su česmenskom vo-

dom i sa 0,5% rastvorom deterdženta. Na osnovu eksperimentalnih rezultata data je ocena upotrebljivosti materijala za izradu rezervoara za čuvanje vode.

THE CONTAMINABILITY OF RUBBER CLOTHES AND THEIR RADIOLOGICAL DECONTAMINATION

Ristić M.

Institute for technical and medical protection — Beograd

This paper describes the estimation of contamination and decontamination of rubber clothes materials that can be used for water storage reservoir construction. The materials are contaminated with the aqueous solutions of radioisotopes ^{131}J, ^{89}Sr and ^{144}Ce + ^{144}Pr. The decontamination tests are conducted with the tap water and 0,5% detergent solution. On the base of the experimental results the usefulness of materials for the construction of water storage reservoir is given.

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DEKONTAMINACIJE ODEĆE KONTAMINIRANE ČESTICAMA RADIOAKTIVNIH PADAVINA POSTUPKOM HEMIJSKOG ČIŠĆENJA

Matijašić A., Stojanović B., Blagojević R., Zarić M.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Ispitivana je mogućnost primene postupka hemijskog čišćenja za dekontaminaciju odeće i drugih predmeta izrađenih od različitih vrsta tekstilnih materija (vuneno i pamučno predivo), u uslovima kontaminacije česticama lokalnih radioaktivnih padavina, koje nastaju posle površinske eksplozije nuklearnih oružja.

Kontaminacija ispitivanih uzoraka vršena je sintetičkim česticama radioaktivnih padavina, markiranih sa radioizotopom Ce^{141}, a faktor dekontaminacije određivan je

za ciklus normalnog programa rada mašine za hemijsko čišćenje. Dobijeni su potpuno zadovoljavajući rezultati dekontaminacije za ispitivane uslove.

DRY CHEMICAL CLEANING PROCESS AS A METHOD FOR THE RADIOLOGICAL DECONTAMINATION OF CLOTHES, CONTAMINATED WITH FALLOUT PARTICLES

Matijašić A., Stojanović B., Blagojević R., Zarić M.

»Boris Kidrič« Institute of Nuclear Sciences — Vinča

The applicability of the chemical cleaning process for decontamination of clothes and other textile ware (woolen and cotton fibres), contaminated with local fallout particles after a ground surface shot is investigated.

The clothes are contaminated with the synthetic particulate contaminant, tagged with the radioisitope ^{141}Ce. The decontamination effectiveness is estimated for the whole cleaning cycle under the normal working conditions of the machine. The experimental results show that the chemical cleaning process could be effectvely applied for the radiological decontamination of clothes.

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RADIOLOŠKA DEKONTAMINACIJA ODEĆE PROCESOM MAŠINSKOG PRANJA

Mijović D., Jelić Lj., Božović R., Ristić M., Cavrić I.

Institut tehničko-medicinske zaštite — Beograd

Ispitivana je radiološka dekontaminacija odeće postupkom standardnog pranja u mašinama velikog kapaciteta. Vunena i pamučna odeća je kontaminirana sintetičkim praškastim kontaminantom obeleženim sa radioizotopom ^{141}Ce. U procesu pranja korišćeni su domaći komercijalni deterdženti. Eksperimentalni rezultati su pokazali da proces pranja efikasno može da se primeni za dekontaminaciju odeće, kontaminirane česticama radioaktivnih padavina.

LAUNDERING AS A METHOD FOR THE RADIOLOGICAL DECONTAMINATION OF CLOTHES

Mijović D., Jelić Lj., Božović R., Ristić M., Cavrić I.

Institute for technical and medical protection — Beograd

For the purpose of radiological decontamination of clothes standard laundry process in high capacity washing machines is evaluated. Woolen and cotton clothes are contaminated with synthetic particulate contaminant tagged with radioisotope ^{141}Ce. For the washing process common commercial detergents are used. The experimental results have confirmed that clothes, contaminated with fallout particles, can effectively be decontaminated by laundering process.

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MATERIJE ZA RADIOLOŠKU DEKONTAMINACIJU POVRŠINA RASTVORNE U MORSKOJ VODI

Jelić Lj., Božović R.

Institut za tehničko-medicinsku zaštitu — Beograd

U radu je opisan način pripreme novih materija za radiološku dekontaminaciju rastvornih u morskoj vodi, koje se sastoje od površinsko aktivnih supstanci i kompleksirajućih materija. Odnosi komponenata u smeši i optimalne koncentracije u morskoj vodi određene su eksperimentalnim putem. Ogledi dekontaminacije izvedeni su na obojenim metalnim površinama. Eksperimentalni rezultati ukazuju na to da materija za dekontaminaciju koja sadrži nejonogene površinsko aktivne supstance i Na-heksametafosfat može efikasno da ukloni sa površina čestice, nečistoće kao i radiokontaminant u obliku katjona, jer reaguje i kao materija za pranje i kao kompleksirajući agens.

SEA WATER SOLUBLE DECONTAMINATING AGENTS

Jelić Lj. i Božović R.

Institute for Technical and Medical Protection — Beograd

In this work the preparation of new sea water soluble decontaminating agents, consisting of surface active substances and complexing agents, is described. The proportions of compounds in mixture and their optimal concentrations in the sea water are determined experimentally. The decontamination tests are conducted on several painted metal surfaces. The experimental results indicate that an agent consisting of nonionic surface active agent and sodium hexametaphosphat, acting like detergent and complexing agent, can effectively remove particulate matter, dirt and cationic contaminants from surfaces.

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DISTRIBUCIJA Ćs-137 i Sr-90 U PŠENICI I RAZNIM VRSTAMA HLEBA

Radovanović R., Brnović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

U ovom radu dat je pregled merenja koncentracija Cs-137 i Sr-90 u zrnima pšenice, raznim vrstama brašna i hleba, i mekinjama od iste.

Pri mlevenju pšenice utvrđen je udeo pojedinih vrsta brašna, pa se merenjem koncentracija Cs-137 i Sr-90 u istim može pratiti distribucija ovih radionuklida.

Poznavanjem ove distribucije može se u izvesnom smislu uspostaviti opšti dekontaminacioni postupak za pšenicu kontaminiranu putem radioaktivnih padavina i ovim radionuklidima iz zemljišta, u toku rasta biljki.

DISTRIBUTION OF Cs-137 AND Sr-90 IN WHEAT AND VARIOUS SORTS OF BREAD

Radovanović R., Brnović R.

Institute of Occupational and Radiological Health

In this paper a review of the measurements of Cs-137 and Sr-90 concentrations in the grains of wheat, various sorts of flour and bread, and bran was given.

At grinding grains into flour a share of individual sorts of flour was established, and by measurement of Cs-137 and Sr-90 concentrations in it the distribution of these radionuclides may be followed.

By knowledge of this distribution a general decontamination procedure for wheat contaminated by radioactive fallouts and these radionuclides from the soil during growth of the plants may be established in a certain sense.

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DEKONTAMINACIJA RADIOAKTIVNIH EFLUENTOV

Pirš M.

Nuklearni institut »Jožef Stefan«, Ljubljana

Kationski izmenjalec s stabilno strukturo smo sintetizirali iz bentonita in šote. Raziskave so pokazale, da izmenjalec dobro veže cezij in stroncij, ne adsorbira pa trovalentnih elementov. Kapaciteta je odvisna od koncentracije raztopine. V prisotnosti alkalijskih soli veže cezij selektivno. V razredčenih cezijevih raztopinah prisotnost alkalijskih soli ne vpliva na kapaciteto, pri višjih koncentracijah pa se kapaciteta zniža.

DECONTAMINATION OF RADIOACTIVE EFFLUENTS

Pirš M.

Nuclear Institute »Jožef Stefan« — Ljubljana

A cation exchanger with stable granular structure from montmorillonit clay and peat was synthesized. The

investigations showed that the exchanger absorbs caesium and strontium well but does not absorb the trivalent elements. The capacity depends on the concentration of the solution. In the presence of alkali salts the exchanger absorbs caesium selectively. In dilute solutions of caesium, the presence of alkali salts does not influence the capacity and at higher concentrations the capacity is lower.

A — 15

RAZVOJ KOMBINOVANOG POSTUPKA ZA UKLANJANJE SMEŠE ^{90}Sr i ^{137}Cs IZ RADIOAKTIVNIH EFLUENATA

Švabić A., Knežević D.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U radu je ispitivan efekat kalcijum-fosfatne i feri--hidroksidne koprecipitacije, a zatim efekat procesa jonske izmene na sintetskoj smoli Amberlit IR 120, na dekontaminaciju Sr i Cs iz smeše. Ispitan je dalje kalijum-kobalto--fero-cijanid kao selektivni izmenjivač za cezijum.

U radu je dalje prikazan kombinovani postupak koji se sastoji iz koprecipitacije, jonske izmene na smoli Amberlit IR 120 i selektivne jonske izmene na ispitanom izmenjivaču za cezijum, za dekontaminaciju efluenata smeše fisionih produkata u kojima su radiokomponente ^{90}Sr i ^{137}Cs. Dobijeni rezultati izraženi su preko faktora dekontaminacije i procenta uklonjene aktivnosti. Na kraju je dat i materijalni bilans kombinovanog postupka.

THE DEVELOPMENT OF A COMBINED METHOD FOR ^{90}Sr + ^{137}Cs MIXTURE REMOVAL FROM RADIOACTIVE LIQUID WASTES

Švabić A., Knežević D.

»Boris Kidrich« Institute of Nuclear Sciences — Vinča

The investigation of ^{90}Sr + ^{137}Cs mixture removal from waste solutions by coprecipitation with $Ca_3(Po_4)_2$ and

$Fe(OH)_3$ and by ion exchange on Amberlit IR 120 is described.

For the purpose of selective removal of ^{137}Cs from effluents containing mixed fission products, the selective absorption of Cs^+ on potassium hecaxyano-cobalt (II) ferrate (II) is estimated.

Furthermore the description if given of combined methods for decontamination of the fission products effluents containing two active radiocomponents — ^{90}Sr + ^{137}Cs, consisting of coprecipitation, ion exchange on Amberlite IR 120 and selective ion exchange of Cs^+. The obtained results are represented by decontamination factors and percentage of activity removal. The material balance is calculated for the whole combined process.

A — 16

SORPCIJA RADIONUKLIDA IZ RASTVORA SOLI NA SINTETIČKOM ZEOLITU LINDE 4A

Janković-Gaćinović O., Radovanov P., Gal I., Vuković Ž.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Ispitana je sorpcija Cs-137, Sr-89, Ru-106 i Co-60 iz rastvora NaCl na sprašenom zeolitu Linde 4A. Sorpcija Cs-137, Sr-89 i Co-60 iz rastvora NaCl koncentracije $4 \cdot 10^{-3}$ — 0,5 M sledi zakon o dejstvu masa. Na osnovu molarnih distribucionih koeficijenata definisanih kao:

$$D = \frac{Io - Ir}{Ir} \cdot \frac{n}{m}$$

dobijen je sledeći redosled afiniteta prema zeolitu 4A:

$$Sr^{++} > Co^{++} > Cs^{+} > Ru^{++}$$

SORPTION OF SOME RADIONUCLIDES FROM SALT SOLUTIONS ON SYNTHETIC ZEOLITE LINDE 4A

Janković-Gaćinović O., Radovanov P., Gal I., Vuković Ž.

»Boris Kidrič« Institute of Nuclear Sciences, — Vinča

The sorption of Cs-137, Sr-89, Ru-106 and Co-60 from NaCl solutions on powdered zeolite Linde 4A is investigated. The sorption of Cs-137, Sr-89 and Co-60 from NaCl solutions $4 \cdot 10^{-3}$ — 0,5 M follows the mass-action low. On the basis of the molal distribution coefficients defined by:

$$D = \frac{Io - Ir}{Ir} \cdot \frac{n}{m}$$

the following sequence of affinity toward the 4A zeolite was found:

$$Sr^{++} > Co^{++} > Cs^{+} > Ru^{++}$$

A — 17

PRIJEDLOG ZA MJERENJE KONTAMINACIJE U LABORATORIJAMA ZA RAD SA OTVORENIM IZVORIMA

Cerovac H., Hufnus R., Benčak Ž.

APSTRAKT NIJE DOSTAVLJEN

USLOVI RADA, EKSPOZICIJA ZRAČENJU I ZDRAVSTVENO STANJE LICA ZAPOSLENIH U RENDGEN KABINETIMA

Pejušković B., Poljak B., Nikolić O., Zlatić V.

Higijenski zavod VMA — Beograd

U radu su izneseni rezultati praćenja uslova rada u rendgen kabinetima, vremenska ekspozicija zračenju zaposlenih lica, praćenje film-dozimetrije, stanje zaštite i zdravstvenog stanja ljudstva kroz period od pet godina.

Uslovi rada u rendgen kabinetima su dobri. Kod 96 lica praćenih film-dozimetrijom, prosečne godišnje doze mR kreću se od 120 do 312 mR. Nema prekoračenja godišnje doze od 5 R. Samo kod 15 lica u toku 5 godina prekoračena je mesečna doza od 400 mR. Srednja dnevna efektivna ekspozicija rendgen zračenju iznosi: za rendgenologe-24 min., za hirurge-10 min., za rendgen tehničare-2 min. i 5 sek., za bolničare-61 minut. Zaštita na radu, kako lična tako i opšta je u skladu sa propisima i zadovoljava. Rutinske metode kontrole zdravstvenog stanja kod 57 zaposlenih osoba (26 muškaraca i 31 žena) koji su se sastojali u kliničkom-specijalističkom pregledu, kompletnom laboratorijskom pregledu krvi i mokraće, nisu pokazali otstupanja od normalnih vrednosti, niti oštećenje koje bi imalo karakter profesionalnog.

CONDITIONS OF WORK, THE EXPOSING TO RADIATION AND HEALTH CONDITION OF THE PERSONS EMPLOYED IN X-ray LABORATORIES

Pejušković B., Poljak B., Nikolić O., Zlatić V.

Hygienic Institute VMA — Beograd

In the paper the results of observing the work condition in X-ray laboratories and exposing to radiation of employed people during the time, observation by film--dosimetry of the state of protection and health condition

of the staff through a period of five years, have been described.

Work conditions in X-ray laboratories are good. Average annual doses in mR range from 120 to 312 mr. in 96 persons observerd by means of film dosimetry. There wasn' t any oversteping dose for 5R in a year.

The monthly dose 400 mR has oversteped only in 15 persons during 5 years. The mean daily effective exposing to X-ray radiation amounts to: for radiologists 24 min., for surgeons 10 min., for X-ray technicians 2 min. and 2 sec., nurses 61 min. The protection on the place of work, the personal as well as general as in keeping with regulations is satisfactory. The rutine methods of the control of health condition of 57 employed persons (36 male and 31 female) which consisted of complete laboratory examination of blood and urine didn't show any deviations from the normal values, no a sort of damage which could be termed professional.

B — 19

HIGIJENSKO TEHNIČKI RADNI USLOVI I ZDRAVSTVENO STANJE OSOBLJA U ZONI X ZRAČENJA, PREMA DOSADAŠNJIM KONTROLAMA U SR MAKEDONIJI

Teodosievski G., Zafirov P., Kalendarov Z., Petreski B.

Zavod za zdravstvenu zaštitu SRM — Skopje

Od brojnih mogućih mirnodopskih primena X zračenja, njegovo korišćenje u medicini (dijagnostici i terapiji) još uvek zauzima dominirajuće mesto.

Na osnovu višegodišnjeg rada na kontroli X zračenja u radnoj sredini, iznećemo podatke o nađenom stanju higijensko-tehničkih uslova njegove primene u medicini, stepen izloženosti zračenju radnog osoblja i mere zaštite koje se preduzimaju.

Isto tako biće izneto zdravstveno stanje osoblja koje radi u zoni X zračenja na bazi kontrolnih medicinskih pregleda.

THE HYGIENO-TECHNICAL CONDITIONS OF WORK AND THE STATE OF HEALTH OF THE PERSONNEL IN THE X-RAY REGION ACCORDING TO HITHERTO CONDUCTED CONTROLS IN THE SR OF MACEDONIA

Teodosievski G., Zafirov P., Kalendarov Z., Petreski B.

Republic Institute of Public Health — Skopje

Of the numerous possible peaceful uses of X-irradiation, the one in medicine for diagnostic and therepeutic purposes still occupies a domineering position.

On the ground of many years of work on the contral of X-irradiation in the working environment we will present data on the hygieno-technical conditions of its use in medicine, the degree of exposure of the working personnel, and the measures of protection undertaken.

Also we will present the state of health of the personnel working in X-irradiation regions on the ground of control medical examinations.

B — 20

PRIKAZ NEKIH METODA KORIŠĆENIH U MEDICINSKOJ KONTROLI RADNIKA IZLOŽENIH IZVORIMA JONIZUJUĆIH ZRAČENJA

Aleksić B.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U radu su prikazane neke do sada kod nas retko primenjivane metode, a koje se odnose na ispitivanje nervnog i vaskularnog sistema. Uporedo su dati prvi rezultati dobijeni pregledom jedne grupe radnika koji su u toku rada izloženi spoljnjem gama zračenju. Kod jednog manjeg broja osoba dolazilo je posebno do ozračivanja šaka beta i gama emiterima. Na osnovu dozimetrijskih podataka, dobijenih preko penkala i film dozimetara, nije dolazilo do prekoračenja maksimalno dozvoljenih doza.

Za pojavu funkcionalnih promena u analizatorskim sistemima praćen je prag bola, adaptacija na bol, diskri-

minaciona osetljivost kao i tonus muskulature nadlaktica. Procena stanja i broja kapilara na prstima ruku određivana je pomoću kapilaroskopa.

Neurološka ispitivanja pokazala su promene u smislu sniženog praga bolne osetljivosti i produžene adaptacije na bol. Promene su bile češće kod osoba sa većom akumuliranom dozom. Promene na kapilarima nađene su takođe kod osoba sa većom akumuliranom dozom i kod osoba kod kojih je dolazilo posebno do ozračivanja šaka.

Prikazane metode nisu specifične za efekte jonizujućih zračenja, ali mogu da se koriste u medicinskoj kontroli pored već uobičajenih metoda, koje se primenjuju pri pregledima lica zaposledih u zdravstvenim i industrijskim ustanovama koje koriste izvore jonizujućih zračenja.

A REVIEW OF SOME METHODS USED IN THE MEDICAL CONTROL OF WORKERS EXPOSED TO INIZING RADIATION

Aleksić B.

Institute of Nuclear Sciences »Boris Kidrič« — Vinča

The paper presents some methods, rarely employed in our country, which concern the study of the nervous and vascular system. A comparison of the first results of examinations of workers professionally exposed to external gamma radiation is given. In a smaller number of workers the hands were irradiated with beta and gamma emitters. According to the dosimetric data obtained from the pen and film dosimeters, no excess of the maximum permissible doses have been ebserved.

For the appearance of functional changes in the analyzer systems the threshold of the pain, adaptation to pain, discrimination sensitivity and upper arm muscular tonus, have been observed. The state and number of capillaries on the fingers were estimated with a capillariscope.

Neurologic examinations have revealed changes, i.e. reduced threshold of painful sensitivity and prolonged adaptation to pain. The changes were more pronounced in persons with higher accumulated doses. Changes in the capillaries were also found in persons with high accumul-

ation doses and in persons whose hands were exceptionally irradiated.

The methods presented are not specific for ionizing radiation effects, but they can be used in medical control in addition to the routine methods used for examination of persons working in health protection and industrial institutions in which ionizing radiation sources are used.

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STANJE OPERATIVNE TEHNIKE PRI UPOTREBI RENTGEN APARATA U DIASKOPIJI I PROBLEMI RADIOLOŠKE ZAŠTITE

Čerkez F., Simić B.

Institut za higijenu i socijalnu medicinu — Sarajevo

Anketiranjem određenog broja ljekara u SRBiH smo istraživali elemente operativne tehnike u radu sa rentgen aparatom kao što su veličina napona, jačina struje, adaptacija vida na mrak, korištenje zaštitnih sredstava i sl.

Dobiveni rezultati studije o stanju operativne tehnike su prikazani i evaluirani upoređivanjem sa ispravnim procedurama.

U radu se raspravlja o značaju pojedinih faktora pri korištenju rentgen aparata i mogućnosti unapređenja dijagnostičke tehnike i radiološke zaštite za pacijenta i operatora.

THE OPERATIVE TECHNIQUES EMPLOYED IN THE USE OF X-RAY UNITS AND THE RADIOLOGAL PROBLEMS

Čerkez F., Simić B.

Institute for Hygiene and Social Medicine — Sarajevo

The authors surveyed a determined number of Physicians in SRBH for the elements of operative techniques employed in the use of X-ray in medical practice such as voltage, milliamperage, the adaptation of eyes to darkness, use of personnel protective equipment etc.

The results of the study of the operative techniques are presented.

The authors have outlined the necessary measures for the improvement of radiological protection by employing proper operative procedure in the use of X-ray units.

B — 22

OBREMENJENOST OSEBJA PRI RENTGENOLOŠKIH PREISKAVAH

Fabjančič G.

Zavod za varstvo pri delu — Ljubljana

Porazdelitev sekundarnega žarkovja v prostoru; smoterna porazdelitev rentgenskih prostorov; razne pomanjkljivosti pri rentg. aparatih kot dodatem vzrok večje obremenjenosti osebja; osebna zaščitna sredstva.

RADIATION EXPOSURE OF PERSONNEL DURING X-RAY EXAMINATIONS

Fabjančić G.

Institute for Work Protection — Ljubljana

Distribution of secondary radiation in the premises; planned arrangement of X-ray premises; various shortcomings of the X-ray apparatus as a reason for larger exposure of personnel; personal means of protection.

B — 23

STANJE RADIOLOŠKE ZAŠTITE KOD IZVORA JONIZUJUĆIH ZRAČENJA U SR BIH

Čerkez F., Simić B.

Institut za higijenu i socijalnu medicinu — Sarajevo

Biološke štetne posljedice koje nastaju nakon izlaganja jonizujućim zračenjima i zakonski propisi uslovljavaju

registrovanje i ispitivanje radiološke zaštite svih izvora zračenja. Tehnika kontrole izvora zračenja, mjerenja doza zračenja na određenim mjestima, instrumentacija, stanje pomoćnih sredstava i rentgen kabineta su u studiji prikazani.

Rezultati studije su prikazani na dvije tabele.

Izloženi su prijedlozi unapređenja radiološke zaštite.

THE WIDESPREAD USE OF MEDICAL X-RAY UNITS AND RADIOLOGICAL PROTECTION IN SRBH

Čerkez F., Simić B.

Institute for Hygiene and social Medicine — Sarajevo

In the introduction the authors examine the health hazards which follow after ionizing radiation.

The need for continuous routine monitoring of X-ray units is discussed. The techniques which are used for the monitoring of X-ray units, structural schields, personnel protective equipment etc. are outlined.

The results of the study are shown in two tables.

The conclusions and recommendations for the improvement of radiological protection are presented.

B — 24

ZAŠTITA PACIJENATA PRI SNIMANJU ZUBA I DOZE ZRAČENJA

Tomašević M.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

U ovome radu su prikazani rezultati merenja doza zračenja kojima se izlažu pacijenti prilikom grafije zuba i to u predelu glave, sternuma i genitalnih organa. Sem toga, izvršena su merenja širine ozračenog polja pri kontaktnom snimanju.

Merenja doza zračenja dobijena su sa 100, a merenja širine ozračenog polja sa 50 rendgen aparata različitih tipova i porekla na teritriji SR Srbije, a posebna pažnja

je posvećena aparatima tipa DENT (Elektronska industrija — Niš.

Na kraju rada, dat je osvrt na zaštitu pacijenata od zračenja, koja je, po mišljenju autora danas nedovoljna, a inače neophodna.

THE MEASUREMENT OF QUANTITY OF RADIATION AND THE PROTECTION OF PATIENTS DURING THE X-RAYING OF TEETH

Tomašivać M.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović« — Beograd

This work presents the results achieved during the measurement of quantity of radiation which the patients are exposed to during the radiography of teeth in the region of head, sternum and genitals. Beside that, the measurement of the radiated field during the contact radiography have also been carried out.

The radiation quantity measurements have been obtained on 100, and the radiated field measurements on 50 X-ray apparatuses of various types and origin on the territory of the Socialist Republic of Serbia. Particular attention has been devoted to the apparatus of the DENT (EI — Niš) type.

At the end of this work, a short reference has been made on the protection of patients during the radiation, which, in the opinion of the author, is today rather insufficient, although it is so indispensible.

B — 25

PROBLEMI RADIOLOŠKE ZAŠTITE MEDICINSKOG OSOBLJA I PACIJENATA PRI DIJAGNOSTIČKOJ UPOTREBI RENTGEN APARATA U ZUBARSTVU

Čerkez F., Simić B.

Institut za higijenu i socijalnu medicinu — Sarajevo

Rasprostranjena upotreba rentgen aparata u zubarskoj praksi uključuje profesionalno izlaganje jonizujućem zračenju zaposlenog osoblja i pacijenata.

Pregledom dokumentacije o izvorima jonizujućih zračenja u SRBiH koji se koriste u zubarskoj praksi smo ispitivali stanje radiološke zaštite. U radu smo prikazali tehniku ispitivanja radiološke zaštite zubarskih rentgen aparata, instrumentacije i dr.

Rezultati studije su prikazani na dvije tabele.

Autori su dali prijedloge mjera za unapređenje radiološke zaštite, medicinskog osoblja i pacijenata.

PROBLEMS OF RADIOLOGICAL PROTECTION FOR MEDICAL PERSONNEL AND PATIENTS UNDERGOING DENTAL RADIOGRAPHY

Čerkez F., Simić B.

Institute for Hygiene and Social Medicine — Sarajevo

The widespread use of dental X-ray units includes exposure to ionizing radiation both to medical personnel as well as patients.

Analysing the documentation for the sources of ionizing radiation used in SRBH we have established a state of radiological protection.

In this study we have presented the techniques and instruments which were used.

The results are presented in two tables.

The authors proposed an improvement in general towards radiological protection for medical staff and patients.

B — 26

DOPRINOS ELEKTRIČNE EFIKASNOSTI DETEKCIJE KOD GASNIH SCINTILATORA

Križanović D.

Institut za medicinu rada i radiološku zaštitu SRS »Dr Drag. Karajović« Beograd

Retki gasovi, koji pod dejstvom jonizujućeg zračenja emituju u vidljivom delu spektra, koriste se kao

gasni scintilatori. Ukoliko se uspostavi električno polje povećava se broj fotona.

U ovom radu korišćen je u komori scintilacioni gas Ksenon koji za najmanji potencijal jonizacije ima najveći prinos svetlosti. Varijacije električnog polja iznosile su 500—1500 V cm-1. Dimenzija komore odredila je mogućnost da u nju stane ceo trag čestica koja vrši jonizaciju. Kao izvor jonizacije zračenja korišćen je S-35, aktivnosti 0,01 mCi.

CONTRIBUTION OF ELECTRICAL FIELD TO THE EFFICACY OF DETECTION IN GASEOUS SCINTILLATORS

Križanović D.

Institute of Occupational and Radiological Health »Dr Drag. Karajović« Beograd

Rare gases, which under the effect of ionizing radiations emit in a visible part of the spectrum, are used as gaseous scintillators. If an electrical field can be established the number of photones will be increased. In the chamber a scintillation gas xenon who for the least potential of ionization has the highest yield of the light was used in this paper. Variations of the electrical field amounted from 500—1500 Vcm-1. Dimensions of the chamber ensured full trace of the particle who ionize to be placed in it. As an source of ionizing radiation S-35 activity of 0,01 mCi was used.

B — 27

BRAHITERAPIJA SA RADIJUMOM; PROBLEMI RADIOLOŠKE ZAŠTITE I MOGUĆNOST ZAMENE RADIJUMA SA RADIOAKTIVNIM KOBALTOM (Co-60).

Vujnić V., Merkaš Z.

Radiološki institut Medicinskog fakulteta u Beogradu

Primena radijuma u lečenju malignih oboljenja obavlja se već dugi niz godina. Fokusi sa radijumom aplikuju

se površinski, intersticijalno i intrakavitarno a zajednički naziv ove metodologije jeste brahiterapija.

U fokusima se radijum nalazi u vidu praha $RaSO_4$. Intenzivna upotreba fokusa dovodi do njihovog oštećenja, dol[illegible] do ispuštanja radona a nisu retki ni [illegible] i prskanja fokusa i rasturanja $RaSO_4$, posledice su veoma ozbiljne kontaminacije osoblja, bolničkih odeljenja i uređaja.

Jedina alternativa je zamena radijumskih fokusa sa fokusima koji sadrže radioaktivni kobalt (Co-60) ili neki drugi radioaktivni izotop.

U radu se detaljnije govori o problemima radiološke zaštite kod primene radijuma, daje se opis fokusa sa Co-60 i diskutuje se aktuelnost zamene radijuma, a putem jedne koordinirane akcije stručnih udruženja.

BRAHYTHERAPY WITH RADIUM; THE PROBLEMS OF RADIOLOGICAL PROTECTION AND POSSIBILITY OF REPLACEMENT OF RADIUM WITH RADIOACTIVE COBALT (Vo-60)

Vujnić V., Merkaš Z.

Radiological Institute, Medical Factury, Beolgrade

The use of Radium in the treatment of malignant diseases was performed for a long period of time. Sources with Ra were applicated superficially, interstitially and intracavitary; the common name for this methodology is Brahytherapy. In these sources (colled focuses) Radium is packed as a sulphate ($RaSO_4$). Intensive use of focuses can damage them, the result is Radon leakage and sometimes total break-up, with subsequent heavy contamination of personnel, hospital departments and equipment.

The only alternative is the replace of Ra focuses with focuses containing radioactive Cobalt (Co-60), or some other radioisotope. Details about problems of radiological protection concerning Radium applications, as well as description of focuses with Co-60 are given, and the actuality of replacement of Radium, through the coordinated action of some professional societies, are discussed.

B — 28

ZAŠTITA PACIJENATA PRI PRIMJENI IZVORA JONIZIRAJUĆIH ZRAČENJA U MEDICINI

Božanić I.

APSTRAKT NIJE DOSTAVLJEN

B — 29

ZAŠTITA MEDICINSKOG OSOBLJA I OKOLINE KOD PRIMENE Co-60 U DUBINSKOJ TERAPIJI

Ristić Đ., Vuković S., Gnjatović S.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U referatu su opisane karakteristike kobalt-uređaja, opasnosti koje nastaju kao posledica eksploatacije kobalt--uređaja, osnovni faktori koje treba uzeti u obzir pri planiranju prostorije u kojoj će biti smešten kobalt-uređaj, proračun debljine zaštitnih zidova i eksperimentalna provera sa primerom i dozimetrijska kontrola.

PROTECTION OF MEDICAL PERSONNEL AND ENVIRONMENT IN USING Co-60 FOR DEEP THERAPY

Ristić Đ., Vuković S., Gnjatović S.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča

The paper describes the characteristics of a cobalt instrument, the hazards induced by the exploitation of the cobalt instrument, the elementary factors which have to be taken into consideration when planning the room in which the cobalt instrument will be placed, calculation of the protecting wall thickness, experimental check with an example, and dosimetric control.

REZULTATI KONTROLE INDIVIDUALNO PRIMLJENIH DOZA POMOĆU FILM-DOZIMETRA U PERIODU 1963—1968. GOD.

Mirić I., Mirić P.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U radu su prikazani rezultati petogodišnje kontrole individualno primljenih doza zračenja pomoću film-dozimetra. Dat je kratak prikaz mogućnosti film-dozimetara koji se u Laboratoriji za zaštitu od zračenja IBK koriste za određivanje integralnih doza zračenja.

Posebno su analizirane primljene doze u zavisnosti od različitih faktora (priroda posla, izvori zračenja i dr.).

Analize primljenih doza prvenstveno se odnose na rezultate kontrole u IBK, a dat je i pregled rezultata jednogodišnje kontrole u industriji.

RESULTS OF THE INDIVIDUAL DOSIMETRY CONTROL BY FILM-BADGES IN THE PERIOD 1963—1968.

Mirić I., Mirić P.

»Boris Kidrič«, Institute of Nuclear Sciences — Vinča

The paper deals with the results of five year individual dosimetry control bu film badges. The film pissibilities in detecting the integral radiation doses applied in the Radiation Protection Laboratory have also been described.

The personnel doses depending on various factors such as the nature of work, radiation sources, etc., have particularly been analysed. Analysis of the received doses primarily refers to the control results of the »Boris Kidrich« Institute; the survey of the one year control in industry has also been included.

ODREĐIVANJE Sr^{90} U NEKIM MATERIJALIMA BIOSFERE EKSTRAKCIONOM METODOM

Picer M.

Institut za medicinska istraživanja i medicinu rada, JAZU Zagreb

U radu je prikazana vrlo jednostavna i relativno kratka metoda određivanja Sr^{90} u kišnici, pšenici, mlijeku i životinjskim kostima metodom ekstrakcije Y^{90} tributilfosfatom iz slabo dušično kisele otopine spaljenog ili uparenog uzorka. Prikazani su efekti zajedničke ekstrakcije i sutaloženja kalcija i željeza na talogu itrijevog hidroksida. Proučen je utjecaj koncentracije fosfata na distribucioni koeficijent itrija prilikom ekstrakcije tributil fosfatom. Prikazani su dekontaminacioni faktori Ce^{144}, Ru^{106}, Zr^{95}, Cs^{137}, Sr^{85} te moguće smetnje Y^{91} i njegovog uklanjanja radi mjerenja radioaktivnosti Y^{90}.

DETERMINATION OF STRONTIUM-90 IN SOME SAMPLES OF THE BIOSPHERE BY EXTRACTION METHOD

Picer M.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

A simple and relatively quick method for the determination of strontium-90 in rain-water, wheat, milk and animal bones is described. The method is based on the preferentail extraction of Yttrium-90 by tributylphosphate from a weak nitric acid solution of sample ash to which was added CaO. The effects of calcium, iron and phosphates on determination of yttrium carrier yield and on distribution coefficients of yttrium-90 are discussed.

The radioactive interferences of Ce^{144}, Ru^{106}, Zr^{95}, Cs^{137} and Sr^{85} in determination of Y^{90} activity are dealt with.

METODA ZA ODREĐIVANJE Sr-90 SA ALUMINIJUMOM KAO NOSAČEM ZA Y^{90}

Brnović R., Gvozdanović D.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« Beograd

Izvršena je verifikacija analitičko hemijske metode za određivanje Sr-90, zasnovane na oksalatnom izdvajanju zemnoalkalnih metala uz korišćenje aluminijuma kao nosača za Y-90.

Primena ove metode proverena je na velikom broju uzoraka iz biosfere (mleko, hrana, voda, zemljište, kosti).

Efikasnost izdvajanja Y-90 na nosaču aluminijumhidroksidu je oko 95% i potpuno je selektivno obzirom na dobijeno poluvreme raspada za Y-90 (64,5 sati).

A METHOD FOR DETERMINATION OF Sr-90 BY ALUMINIUM AS A CARRIER FOR Y-90

Brnović R., Gvozdanović D.

Institute of Occupational and Radiological Health
»Dr Dragomir Krajović« — Beograd

Analytico-chemical method for determination of Sr-90, based on oxalate extraction the alkaline earths-metals with use of aluminium as a carrier for Y-90, was verified.

The use of this method was checked up in a great number of samples from biosphere (milk, food, water, soil, bones).

Efficacy of separation of Y-90 on aluminium hydroxide carrier is about 95% and is entirely selective regarding to obtained half-life of decay for Y-90 (64,5 h.).

ODREĐIVANJE Y-90 U MORSKOJ VODI AMONIJEVIM CINAMATOM

Bauman A.

Institut za medicinska istraživanja i medicinu rada JAZU
Zagreb

Sr-90 u morskoj vodi određuje se preko Y-90. Metoda je standardna. Sr-90 se taloži neizotopnim nosačem, u ovom slučaju taloži se kalcij prisutan u morskoj vodi amonijevim oksalatom. Oksalatni talog kalcija i Sr-90 se odvoji, žari na 850^{0}C i otopi solnom kiselinom. Uobičajeni postupak se sastoji u tome da se doda Y-nosač i taloži kao hidroksid. Dosadašnja praksa u našem laboratoriju sastojala se u tome, da se hidroksid otopi i itrij ponovno taloži kao aksalat, te se kao takav broji. Taj postupak imade veliki nedostatak u tome, što se zbog veoma velike količine prisutnog kalcija (do 20 grama) uz itrij taloži i nešto kalcija, pa je prečišćavanje itrija dugotrajno. Novim načinom se talog itrijeva hidroksida otopi solnom kiselinom i kod pH 3—4 taloži itrij amonijevim cinamatom. Takav talog je bez nečistoća i može se brojiti.

Preračunavanje je vrlo jednostavno.

THE DETERMINATION OF Y-90 IN SEA WATER BY AMONIUM CYNAMATE

Bauman A.

Institute for Medical Research, Yugoslav Academy
of Sciences and Arts — Zagreb

Sr-90 in sea water is being determined by Y-90. The method is standard. Sr-90 precipitates with non-isotopic carrier, in this case Ca precipitates present in the sea water with ammonium oxalate. The oxalate deposit of Ca and Sr-90 is being separated, heated at 850^{0}C and solved by salt acid. The usual process consists in adding the Y-carrier and deposition as hydroxide. The usual practice in our la-

boratory consisted in solving the hydroxide and the yttrium deposits again as an oxalate, and is counted as such. The procedure suffers from a great shortkoming, namely the very great amount of the Ca present (up to 20 grams) makes the deposition of some Ca in addition to yttrium, so that the purification of yttrium takes a long time. By the new method the deposit of yttrium hydroxide is solved by salt acid and in pH 3—4 deposits yttrium by ammonium cynamate. Such a precapitate is without impurities and can be counted. Recounting is very simple.

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ODREĐIVANJE Sr^{90} U MLIJEKU IONSKOIZMJENJIVAČKOM METODOM

Picer M., Filipović V.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

Prikazana je metoda određivanja Sr^{90} u pepelu mlijeka kombinacijom taložne i ionoizmjenjivačke tehnike rada. Prilikom analize izvjesna količina dušične kisele otopine pepela mlijeka propusti se kroz kationsko izmjenjivačku smolu te se nakon ispiranja s 1N HCl Sr^{90} i ostali kationi eluiraju sa 6N HCl. U eluatu talože se željezni i drugi hidroksidi dodatkom NH_4OH, talog odbaci a otopina se ostavi stajati do uspostavljanja radioaktivne ravnoteže $Sr^{90} \rightarrow Y^{90}$. Nakon dodavanja itrijevog nosača taloži se $Y(OH)_3$, talog se centrifugiranjem odvoji, otopi u par kapi 6N HNO_3, zatim se taloži $Y_2(C_2O_4)_3$ suši i broji.

U slučaju prisustva Ba^{140} u mlijeku, prije taloženja itrijevog oksalata otopina itrijevog hidroksida propusti se kroz ionoizmjenjivačku smolu radi odvajanja Y^{90} od La^{140}.

Na kraju je prodiskutirana mogućnost primjene prikazane metode za određivanje Sr^{90} i u drugim materijalima biosfere.

DETERMINATION OF Sr^{90} IN MILK BY ION EXCHANGE METHOD

Picer M., Filipović V.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

The method for determination of Sr^{90} in milk ash by combined precipitation and ion exchange techniques is described. In the course of analysis a certain quantity of nitric acid solution of milk ash is allowed to pass through the cation exchange resin and after being washed out with 1N HNO_3Sr^{90} and other cations are eluted with 6N HCl. In the eluate the iron and other hydroxsides are precipitated by addition of NH_4OH. The precipitate is discharged and the solution is left to stand until it reaches the radioactive equilibrium $Sr^{90} \rightarrow Y^{90}$. After theaddition of yttrium carrier, $Y(OH)_3$ is precipitated, the precipitate is separated by centrifugation, dissolved in a few drops of 6N HNO_3 and the precipitated $Y_2(C_2O_4)_3$ is dried and counted.

If Ba^{140} is present in milk, before precipitation of yttrium oxalate the solution of yttrium hydroxide chould be allowed to pass through ion exchange resin to separate Y^{90} from La^{140}.

At the end, the possibility of applying this method for determination of Sr^{90} in other samples of the biosphere is discussed.

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ZNAČAJ IZBORA ULTRAZVUČNIH FREKVENCI I INTENZITETA NA HOMOGENIZACIJU RAZLIČITIH SREDINA

Begović J., Jovančević V., Gligorijević J., Nikolić D.

Institut za primenu nuklearne energije u poljoprivredi, veterinarstvu i šumarstvu — Zemun
Veterinarski fakultet — Beograd

Ispitivanje uticaja frekvenci i intenziteta ultrazvuka je vršeno na sistemu rastvarača toluol-voda-etanol.

Korišćen je ultrazvučni generator čije su frekvence bile 100 i 300 kHz, pri različitim intenzitetima.

Sistem rastvarača je sadržao organska i neorganska jedinjenja obeležena tricijumom —^{3}H. Merenjem radioaktivnosti na tečnom scintilacionom brojaču kontrolisano je dejstvo ultrazvuka i iz dobijenih podataka se moglo konstatovati u kom stepenu je postignuta homogenost smešesistema.

THE IMPORTANCE OF SELECTION OF THE ULTRASONIC FREQUENCES AND THE INTENSITY UPON THE HOMOGENIZATION OF DIFFERENT MEDIA

Begović J., Jovančević* V., Gligorijević* J. and Nikolić* D.*

The investigation of the influence of the frequencies and intensity of the ultrasonic generator was performed by the solvent toluol-water-ethanol system.

The ultrasonic generator was used with frequencies of 100 und 300 kHz at different current intensities.

The solvent system contained the organic and inorganic compounds of labelled tritium —^{3}H. By measuring of radioactivity on a liquid scintillation counter the effect of the ultrasonic frequency was cantrolled. From the data obtained the degree of homogeneity of the system could be found.

* Begović J. — INEP, Zemun, Baranjska 15
* Jovančević J. — Veterinary Faculty, Beograd
* Gligorijević J. — Veterinary Faculty, Beograd
* Nikolić D. — Veterinary Faculty, Beograd

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VAKUUMSKO NAPARIVANJE ALFA SCINTILATORA I MERENJE ALFA SPEKTRA

Križman M.
Zavod za varstvo pri delu — Ljubljana

Alfa scintilator se vakuumski naparjuje na izvor zračenja i time omogućava direktan kontakt izvora zračenja scintilatora.

Dat je spektar snimljen na preparatu urina.

VACCUM VAPORIZING OF THE ALPHA SCINTILLATOR AND MEASUREMENT OF THE ALPHA SPECTRUM

Križman M.

Institute for Work Protection — Ljubljana

The alpha scintillator is being vaporized by a vaccum unto a source of radiation thus enabling direct contact of the source of radiation of the scintillator. The spectrum is given obtained from a urine preparation.

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O KALIBRACIJI BETA-DETEKTORA

Miletić M., Novković D.

Institut za nuklearne nauke »Boris Kidrič« u Vinči, Beograd

Opisan je metod računskog određivanja »odgovora« nekog beta-detektora na beta-zračenje izotopa čiji beta-spektar znamo a čiji etalon nemamo, na osnovu podataka dobijenih kalibracijom toga beta-detektora pomoću nekoliko drugih beta-izotopa.

CALIBRATION OF BETA-DETECTORS

Miletić M., Novković D.

»Boris Kidrič«, Institute of Nuclear Sciences, Vinča — Beograd

A metod is described to determine, by caculations, the response of beta-ray detector to beta rays of those isotopes for which we have no standards but their spectra are known. The method is based on the data obtained by cali-

brating the beta-ray detector using some other beta-ray isotopes with known activities and spectra.

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UTICAJ SAMOAPSORPCIJE NA TAČNOST MERENJA NISKOENERGETSKIH BETA-EMITERA 4π METODOM

Paligorić D., Hadžišehović M., Bek-Uzarov Đ., Vujisić B., Močilnik I.

Institut za nuklearne nauke »Boris Kidrič« u Vinči, Beograd

U ovom radu pokazan je uticaj primenjene korekcije za samoapsorpciju na rasturanje rezultata merenja specifične aktivnosti radioaktivnog rastvora ^{35}S.

Primenom korekcije za samoapsorpciju iz samoapsorpcione krive u intervalu debljina od 200—2000 μg/cm² dobijene su niže vrednosti specifične aktivnosti za 4% i veliko rasturanje rezultata zbog čega je za srednju vrednost uzeto u obzir samo 8 izvora od 20. Zato je snimljena samoapsorpciona kriva u intervalu od 20—2000 μg/cm², pri čemu je dobijen oštar pad na početku samoapsorpcione krive. Primenom korekcije iz ove krive dobijeno je rasturanje rezultata od srednje vrednosti od ± 0,1% uključujući 19 izvora.

INFLUENCE OF SELF-ABSORPTION ON THE ACCURACY OF ACTIVITY MEASUREMENTS OF LOW-ENERGY BETA EMITTERS BY 4 Pi METHOD

Paligorić D., Hadžišehović M., Bek-Uzarov Đ., Vujisić B., Močilnik I.

»Boris Kidrič«, Institute of Nuclear Sciences, Vinča — Beograd

This work discusses the influence of self-absorption correction on the deviation of the results obtained from

measurements of the specific activity of ^{35}S radioactive solution.

The application of self-absorption correction from a self-absorption curve that covers the range of 200—2000 μgm/cm², gave rise to a 4% lower specific activity and great fluctuations in results; because of this reason eight sources, in the average, had to be selected out of twenty measured ones. The self-absorption curve has been plotted to cover the range of 20—2000 μgm/cm² which shows a rapid fall in its beginning. Using corrections obtained from this curve, the deviation in the obtained results has been found to be ± 0,1%.

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POSTUPAK STANDARDIZACIJE JEDNOG RADIOAKTIVNOG RASTVORA 4π METODOM

Hadžišehović M., Paligorić D.

Institut za nuklearne nauke »Boris Kidrič« u Vinči, Beograd

U ovom radu je detaljno opisan postupak standardizacije radioaktivnog rastvora na primeru merenja specifične aktivnosti rastvora ^{90}Sr-^{90}Y, koja je ovde izvršena sa ukupnom statističkom greškom od ± 0,05%. Kako se u samoj tehnici pripremanja radioaktivnih uzoraka za merenje i kod određivanja korekcija za apsorpciju zračenja čine sistematske greške koje nezavisno od tačnosti merenja mogu biti uzrok odstupanja rezultata od stvarne vrednosti date u granicama statističke greške, ovde su posebno diskutovani mogući uzroci ovih grešaka. Procenjena maksimalna sistematska greška iznosi 1,3%. Da bi se ispitao uticaj razblaženja, merena su dva ista radioaktivna rastvora različite specifične aktivnosti, od kojih je jedan razblaživan u više nezavisnih razblaženja, a drugi direktno meren.

PROCEDURES OF STANDARDIZATION A RADIOACTIVE SOLUTION by 4Pi METHOD

Hadžišehović M., Paligorić D.

»Boris Kidrič«, Institute of Nuclear Sciences, Vinča, Beograd

In this work has been given detailed description of the procedures of standardization a radioactive solution, for example ^{90}Sr-^{90}Y, for which the total statistical error is found to be ± 0.05%.

Source-preparation technique and absorption-correction determination are sources of systematical errors, which are independent on the accuracy of measurements, can be the cause of deviation of the results from the exact values in the limits of the statistical errors; because of these facts, the possible sources of these errors have been discussed. The maximum systematical error has been estimated to be 1.3%.

The influence of dilution on the error has been examined by measuring the specific activity of two radioactive solutions, one of which has been diluted to 4 independent dilutions, while the other is measured directly.

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UTICAJ DISKRIMINATORA NA SMANJENJE EFIKASNOSTI MERENJA

Jovančević V., Nikolić D., Đorđević D.

Institut za primenu nuklearne energije u poljoprivredi, veterinarstvu i šumarstvu — Zemun

Prikazan je uticaj diskriminatorskih nivoa na efikasnost merenja tečnim scintilacionim brojačem Nuclear Chicago 725. Na beta-spektru tricijuma je pretstavljena veličina izgubljenih impulsa u zavisnosti od položaja diskriminatora. Verovatnoća prolaza impulsa kroz diskriminatorski nivo utoliko je veća ukoliko je energetski nivo im-

pulsa više udaljen od nivoa samog diskriminatora. Stoga efikasnost merenja nije ista za sve oblasti spektra. Ovo ima naročitog značaja kod primene metode odnosa kanala za određivanje efikasnosti merenja niskih aktivnosti.

DISCRIMINATOR CONTRIBUTION TO THE LOSSES IN COUNTING EFFICIENCY

Jovančević V., Nikolić D., Đorđević D.

Institute for application nuclear energy in agriculture, veterinary medicine and forestry — Zemun

In this paper has been pointed out that discriminator setting is one of the factors affecting counting efficiency on Liquid scintillation counter Nuclear Chicago 725. On tritium energy beta spectra are shown the losses in efficiency resulting from discriminator setting. The probability of impulse passing through the discriminator level is larger if the level of energy impulse is farther from the level of the discriminator. Therefore counting is dependent on the area of spectra where counting is performed. This is significant for determination of efficiency by means of channel ratio. method.

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SISTEM ZA VIŠEPARAMETARSKO MERENJE NISKIH RADIOAKTIVNOSTI RADNE OKOLINE

Muždeka S., Koturović A., Stojanović D.

Institut za nuklearne nauke »Boris Kidrič« Vinča

U radu se rasmatra struktura merne stanice kojom je omogućeno višeparametarsko merenje. Opisuju se detalji rešenja koje obuhvata rad sa izvorima analognih jednosmernih i impulsnih signala i koje omogućuje neophodnu

elementarnu obradu dobijenih podataka i njihovo zapisivanje u cifarskom obliku.

Kao ilustracija dati su rezultati merenja dobijeni dugoročnim praćenjem niskog aktiviteta gama zračenja, koncentracije dugoživećih radioaktivnih aerosola i temperature na jednom punktu u toku jednomesečnog perioda.

MULTIPARAMETRIC MEASUREMENT OF ENVIRONMENTAL LOW-LEVEL RADIOACTIVITIES

Muždeka S., Koturović A., Stojanović D.

»Boris Kidrič« Institute of Nuclear Sciences,
Vinča — Beograd

The paper presents the structure of a measuring system for multiparametric measurements. Details are described of the system which includes sources of analogue: direct-current and pulse signals, and enables necessary elementary interpretation of obtained data and their registration in the digital form.

Measurement results are presented which have been obtained by a long observation of the low gamma radiation activity, the concentration of long-lived radioactive aerosols and the temperature at one point for a period of one month.

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KVALITATIVNA I KVANTITATIVNA ANALIZA RADIOAKTIVNIH IZOTOPA GAMA-SCINTILACIONIM SPEKTROMETROM

Vujisić B., Dobrilović Lj.

Institut za nuklearne nauke »Boris Kidrič« u Vinči,
Beograd

Razvijena je metoda za kvalitativnu i kvantitativnu analizu α—β, β—γ, EC—γ, ECβ^+—γ radioaktivnih izotopa

u tečnom agregatnom stanju gama-scintilacionim spektrometrom.

Kao detektor korišćen je kristal NaJ/Tl sa šupljinom dimenzija 45 × 50, 19 × 37 mm, za koga su ispitane sledeće karakteristike:

— zavisnost amplitude impulsa i energetske rezolucije od energije gama zračenja u intervalu energija od 0,059 MeV do 1,339 MeV,
— efikasnost u foto piku u funkciji energije gama zračenja,
— efikasnost u funkciji zapremine uzoraka za razne energije gama-zračenja.

Za matematičku obradu gama spektara, tj. pretstavljanje odgovora detektora polinomom, dat je bazis ortogonalnih vektora i način izračunavanja koeficijenata proizvoljnog vektora u tom prostoru metodom najmanjih kvadrata.

Radi ilustracije postavljene metode izvršena je kvantitativna i kvalitativna analiza smeše izotopa ^{241}Am, ^{54}Mn. ^{22}Na, ^{60}Co. Izvšena je identifikacija svih komponenata i kvantitativno određen sastav smeše sa greškom ± 5%.

QUALITATIVE AND QUANTITATIVE ANALYSIS OF RADIOACTIVE ISOTOPES BY A GAMMA-SCINTILLATION SPECTROMETAR

Vujisić B., Dobrilović Lj.

»Boris Kidrič« Institute of Nuclear Sciences,
Vinča — Beograd

A method has been developed for qualitative and quantitative analysis of α—β, β—γ, EC—γ, ECβ^+—γ radioactive isotopes in liquid state using a gamma-spectrometer.

The detector was a well-type NaI (Tl) crystal, dimensions 45 × 50, 19 × 37 mm the following characteristics of which have been examined;

— dependence of the pulse amplitude and energy resolution on the gamma-ray energy, in the range 0.059 MeV—1.339 MeV.
— efficiency, in the photopeak, as a function of gamma-ray energy;
— efficiency as a function of source volume for different gamma-ray energies.

For mathematical treatment of gamma spectra i.e., assuming the detector response to be a polynomial function, the basis of orthogonal vectors and the mode of calculating the coefficients of the arbitrary vector in this space, have been given by the method of least squares.

As an illustration of this method, a qualitative and quantitative analysis has been carried out for a mixture of ^{241}Am, ^{54}Mn, and ^{22}Na and ^{60}Co; by this method all the components have been identified and their quantities in the mixture determined with an error of $\pm$ 5%.

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OBRADA SPEKTARA GAMA ZRAČENJA NA DIGITALNOJ RAČUNSKOJ MAŠINI

Slavić A., Bingulac P.

Institut »Boris Kidrič« Vinča

Opisan je metod analize spektara gama zračenja na digitalnoj računskoj mašini. Odgovarajući program, napisan u FORTRAN IV jeziku, omogućava obradu pikova (foto, SEP i DEP), pri čemu se kao izlazne veličine mogu dobiti amplitude, položaji centroida, širine i površine pikova sa odgovarajućim greškama. Vreme obrade je 5—10 sek po piku.

Prednosti ovog programa u poređenju sa postojećim sličnim programima su: poboljšana tačnost fitovanja, veća osetljivost u izdvajanju pikova iz fona i mogućnost prilagođavanja programa za obradu većeg broja ulaznih podataka bez bitnih zahteva u pogledu povećanja memoriskog kapaciteta računske mašine.

ANALYSIS OF GAMMA-RAY SPECTRA ON A DIGITAL COMPUTER

Slavić A., Bingulac P.

»Boris Kidrič« Institute of Nuclear Sciences
Vinča — Beograd

The method of gamma-ray spectra analysis on a digital computer is described. The corresponding program written

in FORTRAN IV can be used for the analysis of spectral peaks (i.e. photo, SEP and DEP), in which case the following output results can be obtained: peak heights, centroid positions, FWHM and surfaces of the peaks and respective errors. The analysis takes 5—10 sec. per peak.

The advantage of the program compared with the present similar programs are: improved fitting accuracy, higher sensitivity in peak separation from the background and the possibility of applying the program in the analysis of more input data without essential requirements for increasing the computer memory capacity.

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PRIMENA METODE INTERNOG GASNOG BROJANJA NA MERENJE UKUPNE I SPECIFIČNE RADIOAKTIVNOSTI RAZLIČITIH POLAZNIH MATERIJALA

Hadžišehović M., Bek-Uzarov D., Močilnik I.

Institut za nuklearne nauke »Boris Kidrič« u Vinči, Beograd

U radu su iznete mogućnosti određivanja ukupne i specifične radioaktivnosti neorganskih i organskih supstanci koje sadrže ^{3}H i ^{14}C. Kako na tačnost ovakvog merenja utiču veličine specifične za ovu metodu, koje se u najopštijem slučaju mogu izraziti da zavise od prirode i čistoće polaznog materijala, od načina i kvantitativnosti prevođenja u gasni oblik, preciznog određivanja zapremine sistema i parcijalnog pritiska mernog gasa kao i efektivne brojačke zapremine sistema brojača i svakog pojedinačno, to se sadržaj ovoga rada bazira na tretiranju gornjih zahteva kao osnovnih koji utiču na mogućnost primene opisanog sistema za ovakvu vrstu merenja.

APPLICATION OF THE INTERNAL-GAS COUNTING METHOD IN THE MEASUREMENT OF TOTAL AND SPECIFIC RADIOACTIVITY OF DIFFERENT ORIGINAL MATERIALS

Hadžišehović M., Bek-Uzarov D., Močilnik I.

»Boris Kidrič« Institute of Nuclear Sciences,
Vinča — Beograd

A discussion has been given on the possibility of determining the total and specific radioactivity of organic and inorganic substances containing ^{3}H and ^{14}C.

The accuracy of such measurement depends on the magnitudes specific for this method, which in a most general case can be said to depend on the nature and purity of the original material, on the mode and quantitativity of transfer to gaseous state, on the precise determination of the volume of the system and the partial pressure of the internal radioactive gas, and on the determination of the effective counting volume of the counter system and of each counter individually. Hence, this work deals whith the above mentioned factors as the basis ones which influence the possibility of applying the described system in such measurements.

Propisi — 45

OSVRT NA DOSADAŠNJE PROPISE

Dovijanić S.

APSTRAKT NIJE DOSTAVLJEN

JEDAN PREDLOG POSTUPKA ZA ANALIZU, KOREKCIJU I DOPUNU OSNOVNOG ZAKONA O ZAŠTITI OD JONIZUJUĆEG ZRAČENJA

Bojović P., Mitrović S., Veljković T.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U radu su najpre razmatrani neki faktori koji sa različitim stepenom urgentnosti, širine i sagledavanja problematike sugeriraju potrebu za korekciju i dopunu Osnovnog zakona o zaštiti od jonizujućeg zračenja. U istom cilju izvedena je i kratka analiza ovog zakona sa posebnim osvrtom na njegovu savremenost, dovoljnost i aktuelno sprovođenje. Na kraju iznesen je predlog za detaljniju analizu ovog zakona kao i predlog postupka za pribavljanje informacija neophodnih pri izradi teza i predloga teksta za izmene i korekcije Osnovnog zakona o zaštiti od jonizujućeg zračenja.

A PROCEDURE FOR ANALYSIS ALTERATIONS AND AMENDMENTS OF THE GENERAL LAW ON THE PROTECTION AGAINST IONIZING RADIATIONS

Bojović P., Mitrović S., Veljković T.

»Boris Kidrič« Institute of Nuclear Sciences — Vinča

The paper primarily deals with some factors which more or less suggest urgent necessity for corrections and amendments of the General Law on the Protection against Ionizing Radiations. For the same purposes a brief analysis of this law has been made with particular reference to its contemporary, adequate and current implementation. In conclusion a proposal for a more detailed analysis of this Law is given. A procedure is also proposed for the collection of information needed for framing the theses and proposals for corrections and amendments of the General Law on the Protection against Ionizing Radiations.

PRIPREMA PROPISA ZA TRANSPORT RADIOAKTIVNOG MATERIJALA, USKLADIŠTENJE RADIOAKTIVNIH OTPADNIH MATERIJA, POVREMENA MERENJA I KONTROLU ISPRAVNOSTI MERNIH INSTRUMENATA I ZAŠTITNIH SREDSTAVA

Radovanović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« Beograd

U toku 1968. i početkom 1969. godine izvršene su nužne početne pripreme za donošenje sledećih pravilnika iz oblasti radiološke zaštite:

1. Pravilnik o povremenim merenjima i proveravanju koncentracije stvari i lica i o proveravanju ispravnosti mernih instrumenata i zaštitnih sredstava.
2. Pravilnik o načinu i uslovima smeštaja čuvanja, obrade i uklanjanja radioaktivnih otpadnih materija.
3. Pravilnik o uslovima za prenos, način prenosa i izdavanje odobrenja za prenos, i o načinu kontrole prenosa radioaktivnih materija.

U radu se ukazuje na neke suštinske probleme iz oblasti koje se regulišu ovim propisima.

PREPARATION OF REGULATIONS FOR TRANSPORT OF RADIOACTIVE MATERIALS, STORAGE OF RADIOACTIVE WASTE MATERIALS, PERIODICAL MEASUREMENTS AND ACCURACY CHECK OF THE METER-INSTRUMENTS AND PROTECTIVE MEANS

Radovanović R.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović« Beograd

During 1968 and at the beginning of 1969 indispensable initial preparations for brinding following codes of

regulations in the field of radiological protection were performed:

1. Code of regulations on periodical measurements and checking contaminations of things and persons and accuracy check of the meter-instruments and protective means.

2. Code of regulations on ways and conditions of storage, safekeeping, elaboration and removal of radioactive waste materials.

3. Code of regulations on conditions for transport, way of transport and making approval for transport, and on mode of the control of radioactive material transport.

In this paper it is pointed at some essential problems from the field which is regulated by these regulations.

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PROPISI O SIGURNOSTI NUKLEARNIH POSTROJENJA

Mitrović S.

APSTRAKT NIJE DOSTAVLJEN

Propisi — 49

PROBLEM SIGURNOSTI PRI TRANSPORTU RADIOAKTIVNIH MATERIJA

Ristić Đ.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U referatu se razmatra transport radioaktivnih materija i nužnost postojanja nacionalnih i međunarodnih propisa, opasnosti koje predstavlja transport radioaktivnih materija, mere predostrožnosti i postupak u slučaju akcidenta.

SECURITY PROBLEM IN RADIOACTIVE *MATERIALS TRANSPORT*

Ristić Đ.

»Boris Kidrič« Institute of Nuclear Sciences,
Vinča

The paper deals wtih the problem of radioactive materials transport and the necessity for national and international regulations concerning it, the dangers occuring from radioactive materials transport, preventive measures and practice in a case of radiation accidents.

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OSVRT NA NEKE MEĐUNARODNE PREPORUKE

Ristić Đ., Mirić P., Muždeka S.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U referatu je dat prikaz međunarodne delatnosti na donošenju preporuka koje se odnose na rad sa izvorima jonizujućih zračenja, na instrumentaciju i metode za radijacionu kontrolu.

REVIEW OF SOME INTERNATIONAL RECOMMENDATIONS

Ristić Đ., Mirić P., Muždeka S.

»Boris Kidrič« Institute of Nuclear Sciences,
Vinča

The paper presents a review of the international activities in working out recommendations for work with ionizing radiation sources, instrumentation and methods for radiation control.

PRIMENA VAŽEĆIH PROPISA U RENDGEN KPABINETIMA

Rosić S., Božanić J.

APSTRAKT NIJE DOSTAVLJEN

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PRIMENA AUTORADIOGRAFSKE TEHNIKE U ODREĐIVANJU STEPENA HUMANE INTERNE KONTAMINACIJE SA ^{239}Pu

Janković D., Dobrilović Lj., Cvjetković A.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Izgradnja nuklearnih postrojenja i sve šira primena Pu 239 u raznim granama mirnodopske i vojne nuklearne industrije, uslovljava i povećanu opasnost od interne kontaminacije sa ovim elementom kod sve većeg broja profesija. Obzirom da Pu-239 po svojim radioaktivnim i metaboličkom svojstvima spada u grupu najtoksičnijih radioelemenata razumljiva je i potreba raspolaganja sa efikasnim dijagnostičkim metodama za procenu stepena interne kontaminacije a u cilju obezbeđivanja zdravstvene zaštite ljudstva unutar dozvoljenog nivoa. Kako metoda indirektne dijagnostike bazira na kvantitativnom određivanju sadržaja Pu 239 eliminisanog sa humanim urinom, a u slučajevima hroničnih internih kontaminacija ova eliminacija je veoma mala, te se radi o merenjima vrlo niskih alfa aktivnosti reda 10^{-2} pCi, to za određivanje ovakvih nivoa jedino zadovoljava autoradiografska tehnika koja po svojoj osetljivosti prevazilazi konvencionalne alfa brojačke tehnike.

U radu je dat prikaz korišćene autoradiografske tehnike za određivanje sadržaja Pu 239 iz uzoraka humanih urina sa tabelarno i grafički prikazanim rezultatima.

THE AUTORADIOGRAPHY METHOD APPLIED FOR DETERMINATION OF THE DEGREE OF HUMAN INTERNAL CONTAMINATION WITH ^{239}Pu

Janković D., Dobrilović Lj., Cvjetković A.

Institute of Nuclear Science »Boris Kidrič«
Vinča — Beograd

The construction of nuclear engineering and the more pronounced use of ^{239}Pu in various branches of peaceful and military nuclear industry, carries with it the greater danger from internal contammination with this element in greater number of professions. Because of the fact that ^{239}Pu by its radioactive and methabolic characteristics belongs to the group of the most toxic radioelements, the need to have available the efficient diagnostic methods for evaluation of the degree of internal contamination is understandable in order to provide the health protection of personnel within the permitted level. As the method of indirect diagnostic is based on the quantitative determination of content of ^{329}Pu eliminated with human urine, and in cases of chronical internal contaminations this elimination is very small, so that measurements of very low alpha activities is involved (10^{-2} pCi), for the determination of such levels only the autoradiography method is satisfactory because this method by its sensitivity surpasses the conventional alpha measurement methods.

The paper demonstrates the used autoradiography method for determination of content ^{239}Pu from samples of humane urine, with corresponding tables and graphical indicators.

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RESORPCIJA CEZIJUMA-137 KROZ MEHANIČKI POVREĐENU KOŽU I NJEGOV UTICAJ NA RESTAURACIONE PROCESE

Stajić J., Milovanović A., Milivojević K., Stojanović D., Đukić Z.

Med. zaštita Instituta »Boris Kidrič« Beograd

Ispitivana je brzina resorpcije $^{137}CsCl$ kroz svežu ekscizionu kožnu ranu u funkciji vremena posle kontamina-

cije. Posmatran je uticaj kontaminacije na promene brojnih vrednosti leukocita u perifernoj krvi, na dinamiku kontrakcije rane i na vreme njenog zarastanja. Rezultati pokazuju da je brzina resorpcije najveća u toku prvih 20 minuta posle kontaminacije, kada u organizam prodire najveća količina kontaminanta. Posle tog vremena intenzitet resorpcije naglo opada i posle 70-og minuta ostaje stalno na gotovo istom nivou. Promene broja leukocita u krvi kontaminiranih životinja jasno se razlikuju od odgovarajućih promena u ranjenih svedoka. Dinamika kontrakcije rane je u toku prvih 3 do 5 postoperativnih dana sporija kod kontaminiranih životinja nego u svedoka. Nema statistički značajne razlike u vremenu zarastanja kontaminiranih i nekontaminiranih rana.

RESORPTION OF CESIUM-137 THROUGH MECHANICALLY DAMAGED SKIN AND ITS EFFECT ON REPAIR PROCESSES

Stajić J., Milovanović A., Milivojević K., Stojanović D., Đukić Z.

Institute of Nuclear Science »Boris Kidrič«
Vinča — Beograd

The resorption rate of $^{137}CsCl$ through fresh exised skin wound on the back of rats has been investigated as a function of time after contamination. The affect of contamination on the changes in the leucocyte counts in peripheral blood, on wound contraction dynamics and healing time has been studied. Results have shown that the resorption rate is highest during the first 20 minutes after contamination, when the largest quantity of the contaminant penetrates into the organism. After this time the resorption intensity decreases sharply and after 70 minutes it remains almost at the same level. The changes in the leucocyte counts in peripheral blood of contaminated animals apparently differ from those in wounded controls. During the first 3—5 postoperative days the wound contraction dynamics is slower in contaminated animals than in the controls. No statistically significant difference in the healing time of the contaminated and noncontaminated wounds was found.

UTJECAJ ALGINATA NA TRANSPORT STRONCIJA KROZ DUODENUM

Gruden N.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

Najefikasniji način da se onemogući ugrađivanje radiostroncija u kristale kosti je spriječavanje njegove apsorpcije iz probavnog trakta, pri čemu je osobito važno da se apsorpcija kalcija mijenja što manje. To je od naročitog interesa kod mladog organizma koji radi brzog rasta i razvoja skeleta ima veću potrebu za kalcijem, a manju diskriminatornu sposobnost prema stronciju nego odrasli organizam.

Skoryna i sur. (1964.) prvi su pokazali da se alginatima može znatno smanjiti apsorpcija stroncija u probavnom traktu štakora, a da apsorpcija kalcija ostane skoro nepromijenjena. Nas je zanimalo da li će se radi specifičnosti mladog organizma spomenuti efekt alginata očitovati kod mladih kao i kod odraslih životinja.

Pokuse smo radili metodom »izvrnute crijevne vreće« po Wilson-Wisemanu (1954.). Koristili smo mužjake bijelog štakora stare 6, 16 ili 26 tjedana. Nakon dekapitiranja životinjama smo preparirali duodenum i inkubirali ga tokom 45 min. u modificiranoj Krebs-Ringerovoj otopini na 37°C u prisutnosti O_2. Otopini s mukozne strane dodali smo radioaktivne izotope stroncija i kalcija, a eksperimentalnim uzorcima i 0,05% Na-alginata. Nakon inkubiranja određivali smo aktivnost ^{45}Ca i ^{85}Sr u otopini izvan i unutar crijevne vreće i iz omjera S/M (broj impulsa u min. sa serozne strane (broj impulsa u min. s mukozne strane) odredili koliki je transport stroncija i kalcija kroz duodenalnu stijenku.

Rezultati naših pokusa pokazuju da je djelovanje alginata neovisno o dobi štakora. Oni značajno snizuju transport stroncijuma kroz duodenalnu stijenku, dok transport kalcija ni u jednom slučaju nije bio značajnije smanjen.

THE EFFECT OF ALGINATES ON STRONTIUM TRANSPORT THROUGH DUODENUM

Gruden N.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

The most efficient way of hindering radiostrontium incorporation into bone crystals is to prevent its absorption from the gut with particular attention that calcium absorption remains as much as possible unchanged. This is of special interest in the young organism which, owing to its fast growth and skeletal development, needs more calcium and shows less discrimination against strontium than a grown-up organism.

Skoryna et al. (1964) first showed that the application of alginates can considerably reduce strontium absorption from the gastrointestinal tract of the rat leaving calcium absorption almost unchanged. We were interested to see whether — due to specific physiological conditions of the young organism — this effect of alginates will be the same in the young as well as in adult animals.

In these experiments we used Wilson-Wiseman's (1954) method of everted doudenal sac. Male albino rats 6, 16, and 26 weeks old served as experimental animals. After decapitation the rats' duodenum was prepared and incubated for 45 minutes in a modified Krebs-Ringer solution at 37°C in the presence of oxygen. To the solution on the mucosal side radioactive isotopes of strontium and calcium were added. Sodium alginate (0.05 per cent) was added to the same solution in experimental samples. After incubation ^{45}Ca and ^{85}Sr activities were measured in the solution outside and inside the gut wall and from the ratio S/M (counts per minute on the serosal side (counts per minute on the mucosal side) it was possible to determine the transport of strontium and calcium through the duodenal wall.

The results of our experiments show that the effect of alginates is independent of the age of the rat. Alginates significantly reduce strontium transport through duodenal wall leaving the transport of calcium almost unaffected.

MABILIZACIJA RADIOAKTIVNOG STRONCIJA IZ SKELETA U LAKTACIJI

Momčilović B., Duraković A., Kostial K.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

U pokusu je ispitivan utjecaj trajanja laktacije na mobilizaciju radioaktivnog stroncija iz skeleta nakon jednokratke intraperitonealne primjene 0.5 μCi ^{85}Sr jednoj grupi 4 mjeseca starih ženki prije početka nošenja (dublja inkorporacija), a drugoj na dan okoćenja (plića inkorporacija). Virginelne kontrole, dojilje i legla sa 6 mladih žrtvovane su 3, 12 i 20 dana laktacije, a aktivnost otopljenih mineraliziranih uzoraka skeleta određena je u scintilacijskom brojaču. Rezultati pokazuju da je mobilizacija radioaktivnog stroncija iz skeleta upravno razmjerna trajanju laktacije a obrnuto razmjerna vremenu njegove primjene, s tim da se mobilizira i nakon više od 20 dana od ugradnje u skelet.

SKELETAL MOBILIZATION OF RADIOACTIVE STRONTIUM DUE TO LACTATION

Momčilović B., Duraković A., Kostial K.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

The influence of the length of the lactation period upon radiostrontium mobilization from the skeleton was studied after a single intraperitoneal application of 0.5 μCi ^{85}Sr to one group of 4-month-old female rats prior to the beginning of the gestation period (deep incorporation) and to another group on the day of delivery (superficial incorporation). Virgin controls, lactating rats and litters with 6 baby rats were sacrificed at the end of the 3rd, 12th and 20th day of lactation. The activity of dissoloved ashed skeletal samples was determi-

ned in a scintillation counter. The results show that the skeletal radiostrontium mobilization is directly proportional to the duration of lactation but inversly proportional to the time of it's application. Radiostrontium was found to be mobilized even after more than 20 days from the incorporation into the skeleton.

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TERAPIJA AKUTNE ORALNE KONTAMINACIJE RADIOSTRONCIJEM

Maljković T., Kostial K.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

U terapiji oralne kontaminacije radioaktivnim stroncijem do sada se manje ili više uspješno primenjivala terapija sulfatima, fosfatima i alginatima. U novije vrijeme dobiveni su naročito povoljni reezultati primjenom aluminijeva fosfata u obliku gela (Spencer i suradnici 1967). Za alginatnu terapiju primjećeno je da djelovanje ovisi o visini omjera guluronske prema manuronskoj kiselini (G/M) (Harrison i suradnici 1966, Carr i suradnici 1968),

Svrha naših pokusa bila je da ustanovimo da li je uzrok povoljnijeg efekta aluminijeva fosfata u terapiji interne kontaminacije radiostroncijem u dodatku aluminija ili u primjeni fosfatne terapije u obliku gela. Pored toga, željeli smo ustanoviti da li u terapiji akutne oralne kontaminacije radioaktivnim stroncijem kombinirana terapija alginatima i fosfatima ima određene prednosti kao što smo ustanovili u slučaju kronične kontaminacije (Kostial i suradnici 1967).

Ženke bijelog štakara dobi 8—9 tjedana primile su nakon 48 sati gladovanja stroncij-85 putem želučane sonde. Neposredno nakon toga primjenili smo u raznim grupama štakora fosfatnu, alginatnu i miješanu terapiju. Kontrolna grupa životinja primila je umjesto terapije destiliranu vodu. Fosfatnu terapiju primijenili smo u tri oblika i to kao: kalcijev hidrogen fosfat, aluminijev fosfat u obliku soli i

aluminijev fosfat u obliku gela. Alginate smo primjenili kao natrajeve soli u obliku Manucola SS/LD/2 (G/M 71) i O. G. 1 (G/M 97), a miješanu terapiju kao O. G. 1 i kalcijeva hidrogen fosfata.

Skeletna retencija stroncija-85 određena 72 sata nakon oralne kontaminacije, služila nam je kao mjerilo uspješnosti primjenjene terapije. Iz rezultata se vidi da je efekt fosfatne terapije bio neovisan o kemijskom obliku fosfata kao i o visini primjenjene doze. Maksimalno sniženje retencije radiostroncija primjetili smo nakon primjene miješane terapije.

THE THERAPY OF ACUTE ORAL RADIOSTRONTIUM CONTAMINATION

Maljković T., Kostial K.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

In the therapy of oral radiostrontium contamination sulphates, phosphates and alginates have found so far a more or less successluf application. Recently, particularly good results have been obtained with the application of aluminium phosphate in the form of gel (Spencer et al. 1967). The effect of alginate therapy has been found to depend upon the ratio of guluronic to manuronic acid (G/M) (Harrison et al. 1966, Carr et al. 1968).

The purpose of our experiments was to find out whether the more favourable effect of aluminium phosphate in the therapy of internal contamination with radiostrontium is due to aluminium supplementation or to the application of phosphate gel therapy. Besides, we wanted to see if in the therapy of acute oral contamination with radioactive strontium the combined therapy with alginates and phosphates has certain advantages as was established in the case of chronic contamination (Kostial et al. 1967).

Female albino rats aged 8—9 weeks were administered strontium-85 by way of stomach tube after a 48-hour fasting period. Immediately afterwards phosphate, alginate and combined therapy were applied in different groups of rats. The control group received distilled water instead. The phosphate therapy was applied in 3 forms: as calcium hydrogen phosphate, aluminium phosphate in

the form of salt and aluminium phosphate in the form of gel. Alginates were used as sodium salts in the form of Manucol SS(LD/2/G/M 71) and O. G. 1 (G/M 97), and combined therapy as O. G. 1 and calcium hydrogen phosphate.

Skeletal strontium-85 retention determined 72 hours after oral contamination served as a measure for estimating the effect of the therapy. From the results obtained it is seen that the effect of phosphate therapy was independent of the chemical form of phosphates as well as of the dosage applied. Maximal reduction of radiostrontium retention was observed after the application of combined therapy.

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PREIMUĆSTVA PRIMENE ALFA SPEKTROMETRIJSKE METODE SA POLUPROVODNIČKIM DETEKTOROM U ODNOSU NA JONIZACIONU KOMORU U RADIOTOKSIKOLOCIJI

Radovanović R., Hajduković D.

Institut za medicinu rada i radiološku zaštitu
»Dr.Dragomir Karajović« — Beograd

U ovom radu dat je uporedni pregled mogućnosti i merenja spektara alfa zračenja u biološkom materijalu i nekim uzorcima iz biosfere pomoću alfa spektrometrijskih metoda sa poluprovodničkim detektorom, »ORTEC« model BA-045-300-100 sa aktivnom površinom 3 cm^2 i sa jonizacionom komorom sa rešetkom tip S14 »Intertechnique«.

THE ADVANTAGES OF USE OF ALPHA SPECTROMETRIC METHOD WITH SEMICONDUCTOR DETECTOR OVER IONIZATION CHAMBER IN RADIOTOXICOLOGY

Radovanović, R., Hajduković, D.

Institut of Occupational and Radiological Health
»Dr. Dragomir Karajović«, Beograd

In this paper a parallel review of possibilities and alpha radiation spectra measurement in biological material

and in some samples from biosphere by alpha spectrometric methods with semi-conducting detector, »ORTEC« the model BA-045-300-100 with active surface of $3cm^2$ and ionization chamber with a grating of type S14 Intertechnique« was given.

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METODA ZA MERENJE NISKIH KONCENTRACIJA ^{222}Rn.

Petrović D., Panov D,

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« Beograd

U saopštenju se iznosi princip rada metode za merenje niskih koncentracija ^{222}Rn.

Merenja i metodika su razrađeni za procenu telesnog depoa ^{226}Ra mereći koncentraciju ^{222}Rn u izdahnutom vazduhu. Dat je kratak pregled osnovnih parametara metode sa osvrtom na primenu metode kod merenja izdahnutog vazduha.

Metoda je proverena i određena njena greška za koncentracije od 10^{-10} do 10^{-13} pCi/1.

A METHOD FOR MEASUREMENT OF LOW CONCENTRATION OF ^{222} Rn

Petrović, D., Panov, D.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović«, Beograd

In this observation the principles of the method for low concentration measurements of ^{222}Rn are given

The measurements and methodology for the assessment of body burden of ^{226}Ra are worked out in details, measuring the concentration of ^{222} Rn in expired air. A short review of fundamental parameters of the method with regard to its use in measurements of expired air was given.

The method is verified and its error for concentrations from 10^{-10} to 10^{-13} pC1 is determined.

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PROCENA TELESNOG DEPOA ^{226}Ra NA OSNOVU MERENJA CELOG TELA (W. B. C.) I PREKO ^{222}Rn U IZDAHNUTOM VAZDUHU

Petrović D., Jeremić M., Panov D., Novak Lj., Ranković M.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« Beograd

Kod radnika u industriji satova, preciznih instrumenata i drugih, koji rade sa svetlećim bojama, procena interne kontaminacije je složen problem.

U radu se iznose rezultati dobijeni raznim metodama za evaluaciju telesnog opterećenja ^{226}Ra.

Merenja su vršena preko gama-aktivnosti celog tela i preko aktivnosti ^{222}Rn u izdahnutom vazduhu.

ASSESSMENT OF BODY BURDEN OF ^{226}Ra BASED ON MEASUREMRNTS OF WHOLE BODY CONTING (W. B. C.) AND BY ^{222} Rn IN EXPIRED AIR

Petrović, D., Jeremić, M., Panov, D., Novak, Lj., Ranković, M.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović«, Beograd

In the workers employed in watch industry, industry of precise instruments and the others who operate effectively with luminous paints, the assessment of internal contamination is a complex problem.

In this paper the results obtained by various methods for evaluation of body burden of ^{226}Ra are given.

The measurement are performed by whole body gammaactivity and activity of ^{222}Rn in expired air.

REZULTATI UPOREDNOG PRAĆENJA KONCENTRACIJE URANA U RADNOJ ATMOSFER I U URINU RADNIKA PRI PRERADI URANA

Pantelić Lj., Lazić M., Jeremić M.

Institut za tehnologiju nuklearnih i drugih mineralnih sirovina — Beograd

Institut za medicinu rada i radiološku zaštitu »Dr Dragomir Krajović« — Beograd

U tehnologiji urana u pojedinim fazama procesa dobijanja uran metala osoblje je izloženo mogućnosti kontaminacije organizma jedinjenjima urana.

U radu se iznose rezultati praćenja odnosa urana u radnoj atmosferi i u urinu eksponovanog osoblja.

Ovim ispitivanjima obuhvaćeno je 24 lica, a izvršena je 81 analiza.

RESULTS OF THE STUDY OF URANIUM CONCENTRATIONS IN THE WORKING ATMOSPHERE AND IN THE URINE OF PERSONS WORKING IN URANIUM PROCESSING

Pantelić Lj., Lazić M., Jeremić M.

Institute for Technology Nuclear and other Mineral Row Materials — Beograd

Institute of Occupational and Radilogical Health »Dr. Dragomir Krajović« — Beograd

In the different phases of the production of uranium metal workers are exposed to the possibility of contamination by uranium compounds.

In this paper the results of the study of uranium concentrations in the working atmosphere and in the urine of workers are presented.

During this investigation 24 persons have been examined and 81 analysis have been done.

SINTETSKE I PRIRODNE TVARI POGODNE ZA SNIŽENJE RETENCIJE RADIOAKTIVNOG STRONCIJA U TIJELU

Škarić V., Turjak-Zebić V., Škarić Đ., Kostial K., Maljković T., Gruden N.

Institut »Ruđer Bošković«, Zagreb, i Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

Nastavljena su biološka testiranja 2-fenil-4,5,6,7-tetrahidroindazol-3-on-5,5-dikarbonske kiseline (FIDA) i njenog difenil derivata (HIDA) u svrhu pospješenja eliminacije za dioaktivnog stroncija iz organizma štakora (Škarić i sur. 1967).

Ustanovili smo da intraperitionealna primjena tih kompleksona izaziva sniženje skeletne retencije radioaktivnog stroncija (^{85}Sr) samo ukoliko se ti kompleksoni primjene uz dodatak stroncijevog klorida.

Izvršena je izolacija D-manuronske i L-guluronske kiseline iz alginata »Manucol« SS/LD/2 G/M 2.48. U tu svrhu alginat je bio hidroliziran s 80% sumpornom kiselinom, a separacija uronskih kiselina je izvršena na koloni anionskog izmjenjivača Dowex 1 × 8 (100-200 mesh) u acetatnoj formi Umjesto papirne kromatografije kojom se kvalitativno prati separacija uronskih kiselina, uvedena je nova, mnogo brža metoda njihove detekcije pomoću tankoslojne kromatografije na celulozi.

Metodom potenciometrijske titracije kvalitativno je ispitano stvaranje kompleksa D-manuronske i L-guluronske kiseline s kalcijem odnosno stroncijem u odnosu 2:1 i 1 : 10 liganda prema metalu.

S ciljem da se ispita djelotvornost alginata iz jadranskih smeđih alga pogodnih za sniženje apsorpcije radioaktivnog stroncija iz probavnog trakta dosad su izvršene izolacije alginata iz alge *Cystoseira barbata* i *Colpomenia sinuosa*.

U toku su biološka testiranja natrijevog alginata izoliranog iz *Cystoseira barbata* na izoliranoj duodenalnoj vreći štakora.

SYNTHETIC AND NATURAL AGENTS SUITABLE FOR REDUCING RADIOACTIVE STRONTIUM RETENTION IN THE BODY

Škarić V., Turjak-Zebić V., Škarić Đ., Kostial K., Maljković T., Gruden N.

Institut »Ruđer Bošković« and Institute for Medical Research, Zagreb

The biological testing of 2-phenyl -4,5,6,7-tetrahydro-indazol-3-one-5,5-dicarboxylic acid (FIDA) and its dephenyl sderivative (HIDA) as agents for enhancing radioactive strontium elimination from the body was continued (Škorić et al. 1967).

An intraperitoneal injection of these complexing agents caused a reduction in retention of radioactive strontium (^{85}Sr) in rats only if strontium chloride was applied at the same time.

D-Mannuronic and L-guluronic acids were isolated from alginate »Manucol« SS/LD/2 G/M 2.48. For this purpose the alginate was hydrolised with 80% sulphuric acid. The separation of uronic acids was carried out on the column of anion exchange resin Dowex 1 × 8 (100-200 mesh) in acetate form. Instead of paper chromatography which serves for qualitative identification of uronic acids during the separation, a new, more rapid method by using a thin-layer chromatography on cellulose was introduced.

The potentiometric titration method was applied to investigate qualitatively the ability of D-mannuronic and L-guluronic acids to form complexes with calcium and strontium at molar ratios 2 : 1 and 1 : 10 ligand to metal.

With the aim to investigate the efficiency of alginates from adriatic brown algae as agents for reducing radio-strontium absorption from the intestine, the isolation of alginates from *Cystoseira barbata* and *Colpomenia sinuosa has been done.*

The biological testing of sodium alginate from *Cystoseira barbata* are being carried out by using the method of isolated everted duodenal sack of rat.

UTICAJ DEKONTAMINACIONOG TRETMANA NA PERKUTANU RESRPCIJU RADIOCEZIJUMA

Milivojević K., Stojanović D.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U izučavanju interne kontaminacije nastale transkutanim putem ispitivan je uticaj svojstava radiokontaminanta na dinamiku i stepen resorpcije radiocezijuma i uticaj sredstava i postupaka za dekontaminaciju kože na resorpciju ^{137}Cs. Ispitivana je preventivna uloga zaštitnog krema u smanjenju perkutane resorpcije. Radiokontaminant je bio ^{137}Cs u različitom hemijskom obliku (hlorid, sulfat i nitrat) u rastvoru sa pH 1,0 pri dužini trajanja kontaminacije od 1 časa. Površinsko obezmašćivanje kože je vršeno sapunom pre kontaminacije. Od sredstava za dekontaminaciju ispitana je voda, 5% rastvor deterdženta »BADD« i 2% rastvor taninske kiseline. U ispitivanju prevencije transkutane resorpcije i povećanje efekata dekontaminacije korišćen je zaštitni krem »Octa«. Dobijeni rezultati pokazuju da tretman kože sapunom uslovljava povećanu transkutanu resorpciju radiocezijuma. Voda, korišćena kao sredstvo za dekontaminaciju ne povećava količine ^{137}Cs u organizmu kada je kontaminant jaka kselina. Najefikasnije dekontaminaciono sredstvo od svih ispitivanih materija predstavlja deterdžent »BADD« koji u izvesnoj meri povećava procenat prodrlog cezijuma u telo, ali ostavlja najmanju rezidualnu radioaktivnost u kontaminiranom delu kože što uslovljava procenu stvarne efikasnosti dekontaminacije. Cilj rada je da se dobijeni rezultati na eksperimentalnim životinjama (Albino Wistar) primene u humanoj praksi za zaštitu profesionalno izloženog osoblja radi pružanja odgovarajuće pomoći pri spoljnoj kontaminaciji.

EFFECT OF DECONTAMINATION TREATMENT ON THE PERCUTANEOUS RESORPTION OF RADIOCESIUM

Milivojević M., Stojanović D.

Institute for Nuclear Siences »Boris Kidrič« — Vinča

In studying internal contamination induced by transcutaneous way, ve have investigated the effects of radiocon-

taminants on the dynamics and rate of radiocesium resorption and the influence of the means and procedures for skin decontamination on the resorption of ^{137}Cs.

The preventive effect of the protective cream on the decrease of percutaneous resorption has also been investigated. The radiocentaminant was ^{137}Cs in various chemical forms (chloride, sulphate, nitrate) in a solution of pH 1.0 and the duration of contamination was one hour. Prior to contamination the skin surface was treater with soap.

The decontamination agents: water, 5% solution of the detergent »BADD«, and 2% solution of tannic acid have been investigated.

The protective cream »Octa« was used in investigating the prevention of transcutaneous resorption and the increase of the decontamination effect. The results have shovn that transcutaneous resorption of radiocesium increases if the skin is treated with soap. Water, as a decontamination agent, does not increase the amount of ^{137}Cs in the organism if the contaminant is a strong acid. The most efficient decontaminant is the detergent »BADD«, which, to some extent, increases the percentage of cesium in the organism, but leaves the smallest amount of residual radioactivity in the contaminated part of the skin upon which depends the estimation of the actual efficiency of decontamination. The purpose of (Albino Wistar) in the protection of professionally exposed personnel in order to extend appropriate assistance in external contamination.

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RESORPCIJA RADIOCEZIJUMA PREKO SLUZOKOŽE USNE DUPLJE I MOGUĆNOSTI DEKONTAMINACIJE

Stojanović D., Milivojević K.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Ispitivanja su obuhvatala nastanak interne kontaminacije radiocezijumom preko sluzokože usne duplje, efikasnost dekontaminacionog tretmana i uticaj primenjenih sredstava za dekontaminaciju na resorpciju ^{137}Cs kao i mo-

gućnost smanjenja resorpcije primenom adstringentnih sredstava. Radiokontaminacija je izvedena sa 30 μCi rastvora radiocezijuma u različitom hemijskom obliku (hlorid sulfat, nitrat). U dekontaminacionom tretmanu usne duplje postavljena je originalna metoda, a od sredstava za dekontaminaciju ispitivana je voda i izotonični slani rastvor. U cilju smanjenja transbukalne resorpcije korišćen je 2% rastvor taninske kiseline. Dinamika resorpcije praćena je metodom ekstrakorporalne cirkulacije koja omogućava kontinuirano merenje radioaktivnosti krvi, a ukupni telesni sadržaj prodrlog radiocezijuma meren je pomoću Whole body counter-a za eksperimentalne životinje. Dobijeni rezultati pokazuju da resorpcija preko sluzokoža usne duplje nije zanemarljiva i da proces resorpcije u funkciji vremena posle kontaminacije ispoljava stalni porast radioaktivnosti krvi. Voda i 0,9% rastvor natrijum hlorida primenjeni kao dekontaminaciona sredstva povećavaju procenat prodrlog radiocezijuma u organizam. Rastvor taninske kiseline ispoljava najveću efikasnost dekontaminacije kada je radiokontaminant u obliku hlorida. Cilj rada je da se dobijeni rezultati na eksperimentalnim životinjama (Albino Wistar) primene u humanoj praksi pri pružanju medicinske pomoći akcidentalno kontaminiranim licima.

RESORPTION OF RADIOCESIUM THROUGH THE MUCOUS MEMBRANE OF THE BUCCAL CAVITY AND DECONTAMINATION POSSIBLITES

Stojanović D., Milivojević K.

Institut of Nuclear Siences »Boris Kidrič« — Vinča

The investigations include the appearance of internal contamination by radiocesium through the mucous membrane of the buccal cavity, the efficiency of decontamination treatment, the effect of the decontamination agents on the resorption of ^{137}Cs, and the possibility of reducing resorption by using adstringent agents. Radiocontamination was carried with a 30 μCi solution of radiocesium in various chemical forms (chloride, sulphate, nitrate). Decontamination of the mucous membrane of the buccal cavity was performed by an original method, while water and the isotonic saline solution were investigated as the decontaminats.

In order to reduce transbuccal resorption, a 2% solution of tannic acid was used. The dynamics of resorption was observed by the method of extracorporal circulation which allows continual measurement of blood radioactivity while the total of radiocesium penetrated into the body was measured with a Whole body counter for experimental animals. The results obtained have shown that resorption through the mucous membrane of the buccal cavity is not neglectable and the resorption processas as a function of time after contamination shows a constant increase of radioactivity in the blood. Water and a 0,9% solution of sodium chloride as the decontaminants increase the percentage of radiocesium penetrated into the organism. The best efficiency of decontaminations is achieved with a tannic acid solution when the radiocontaminant is applied in the form of a chloride. The purpose of the work is to use the results obtained on Albino Wistar rats in human practice in extending medical assistance to accidentally contaminated persons.

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MOGUĆNOST PRIMENE BERLINSKOG PLAVOG U SMANJENJU DIGESTIVNE RESORPCIJE ^{137}Cs KOD PERORALNO KONTAMINIRANIH KOKOŠI

Gligorijević J., Begović J., Draganović B., Milošević Z.

Odsek za dijagnostiku i terapiju domaćih životinja INEP Zemun

Mogućnost primene BP kao protektora digestivne resorpcije ^{137}Cs ispitivana je kod kokoši rase »Leghorn« starosti 6 meseci. Kontaminacija je vršena sondom a radiocezijum administriran direktno u voljku. BP kao protekciono sredstvo dodavan je u hranjivu smešu i vodu eksperimentalnih životinja. Radiometrijskim merenjima uzoraka organa ispitivan je protekcioni efekat BP u digestivnoj resorpciji radiocezijuma.

THE POSSIBILITY OF APPLICATION OF PRUSSIAN BLUE IN DECREASE OF DIGESTIVE RESORPTION OF ^{137}Cs WITH PERORALY CONTAMINATED FOLWS

^{137}Cs WITH PERORALY CONTAMINATED FOWLS

Gligorijević, J., Begović*, J., Draganović*, B., Milošević*, Ž.*

The possibility of application of PB as a protector in digestive resorption of ^{137} Cs was examined with fowls of »Leghorn« sort aged six months. Contamination was performed by sonda and the radiocesium was administrated directly into ingluvies. PB as a protective medium was added to the nutritive mixture and water of experimental animals, By radiometric measuring of sample-organs the protective effect of PB in digestive resorption of radiocesium was examined.

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* Gligorijević J., — Veterinary Faculty, Belgrade
* Begović J., — INEP, Zemun, Baranjska 15
* Draganović B., — Veterinary Faculty, Belgrade
* Milošević Z. — Veterinary Faculty, Sarajevo

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MOGUĆNOST PROTEKCIONE PRIMENE EDTA KOD PERORALNE KONTAMINCIJE KOKOŠI $^{85\ 89}Sr$.

Gligorijević J., Draganović B., Begović J., Zagorčić A.

Odsek za dijagnostiku i terapiju domaćih životinja INEP Zemun

Mogućnost radioprotekcije dinatrijevom soli EDTA kod interno kontaminiranih kokoški smešom radiostroncijuma 85, 89 ispitivana je na kokošima rase »Leghorn« starim 6 meseci. Rastvor smeše radiostroncijuma apliciran je sondom u voljku u dozi 2 μCi/kgr. Natrijumova so EDTA davana je pomešana sa hranom i vodom oglednih životinja 7 dana pre aplikacije izotopa. Radiometrijskim merenjima

krvi, fecesa i kostiju skeleta praćena je distribucija radiostroncijuma. Rezultati radiometrijskih merenja uzoraka skeleta pokazuju zaštitni efekat natrijumove soli EDTA, koji se manifestuje smanjenom inkorporacijom radiostroncijuma u skelet kontaminiranih kokoši.

THE POSSIBILITY OF PROTECTIVE APPLICATION OF EDTA BY PERORAL CONTAMINATION IN FOWLS $^{85\ 89}$SR.

The possibility of radioprotection by disodium EDTA salt with internally contaminated folws by radiostrontium 85 · 89 was examined in fowls of »Leghorn« sort aged six months. The solution of mixture of radioisotopes was applied by means of sonda into ingluvies dosed 2μCi/kg. disodium EDTA salt was given mixed with foor and water to the examined fowls 7 days before the isotopes' application.

By radiometric measuring of bload, excretion and skeleton bones the distribution of radiostrontium was followed.

The results of radiometric measuring of skeleton show the protective effect of disodium EDTA salt, manifesting the decreased incorporation of radiostrontium.

* Gligorijević J., — Veterinary Faculty, Belgrade
* Draganović B., — Veterinary Faculty, Belgrade
* Begović J., — INEP, Zemun, Baranjska 15
* Zagorčić A. — Veterinary Faculty, Belgrade

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MOGUĆNOSTI SNIŽENJA APSORPCIJE RADIOSTRONCIJA IZ PROBAVNOG TRAKTA VRLO MLADIH ORGANIZAMA

Žulj-Juvančić V., Kostial K., Pišonić M.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

Poznato je da je apsorpcija kalcija i stroncija iz probavnog trakta vrlo mladih organizama znatno povećana

i da je istovremeno gastrointestinalna diskriminacija prema stronciju snižena. Taj je podatak važan za ocjenu mogućnosti ulaska stroncija-90 u organizam.

Do sada smo u pokusima s tek okoćenim štakorima primjetili da se povišenjem sadržaja fosfata u mlijeku ne može sniziti apsorpcija radiostroncija iz probavnog trakta (Kostial i sur. 1967). Svrha ovih istraživanja je bila da ustanovimo da li se drugim dodacima hrani može utjecati na sniženje ulaska radioaktivnog stroncija iz probavnog trakta životinja te dobi.

Pokusi su vršeni na štakorima 5—7 dana starosti koje smo umjetno hranili pomoću kapaljke kroz 10 sati. Primijenili smo kravlje mlijeko uz dodatak kalcija (kao $CaCl_2$), fosfata (kao KH_2PO_4) i natrijeva alginata (kao O. G. 1). Sadržaj kalcija u mlijeku kretao se od 400—1000 mg/100 ml, a fosfata od 230—500 mg/100 ml. Alginate smo dodali u količini od 2 gr na 100 ml. Svi uzorci mlijeka označeni su radioaktivnim kalcijem ($^{45\ 47}Ca$) i stroncijem (^{85}Sr).

Količinu radioaktivnog kalcija i stroncija u tijelu odredili smo nakon 40 sati iza odstranjenja probavnog trakta. Kalcij-45 određivali smo u GM brojaču s prozorom, a stroncij-85 i kalcij-47 u scintilacijskom brojaču s jednokanalnim amplitudnim analizatorom. Svi rezultati izraženi su u postotku oralne doze.

Iz rezultata se vidi da se apsorpcija radioaktivnog stroncija iz probavnog trakta životinja te dobi može značajno sniziti jedino dodatkom natrijeva alginata hrani (za oko 60%).

POSSIBILITIES OF REDUCING RADIOSTRONTIUM ABSORPTION FROM THE GASTROINTESTINAL TRACT IN THE VERY YOUNG

Žulj-Juvančić V., Kostial K., Pišonić M.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

It is known that calcium and strontium absorption from the gut in the very young is significantly increased and that at this age discrimination against strontium is reduced. This fact is important in the evaluation of Sr-90 body intake.

In the experiments performed so far on new-born rats we found that it is not possible to reduce radiostrontium absorption from the gut by increasing the phosphate content in the milk (Kostial et al. 1967). The purpose of these experiments was to estabilish whether other dietary supplements can influence the intestinal radiostrontium absorption in animals of this age.

Experiments were performed on 5—7 day old rats artificially fed by means of a dropper for about 10 hours. To cow's milk were added calcium (as $CaCl_2$), phosphates (as KH_2PO_4) and sodium alginate (O. G. 1). Calcium content in the milk varied from 400—1000 mg/100 ml and the content of phosphates from 230—500 mg/100 ml. Alginates were added in the amount of 2 g per 100 ml. Tracer amounts of radioactive calcium (^{45} ^{47}Ca) and strontium (^{85}Sr) were also added to the milk.

The amount of radioactive calcium and strontium in the body was measured 40 hours later after the removal of the gastrointestinal tract. Calcium-45 was determined in a GM end-window counter while strontium-85 and calcium-47 were determined in a scintillation counter connected to a single channel analyzer. All results are expressed as percentage of oral dose.

From the results obtained it is concluded that radiostrontium absorption from the gut in the very young animals can be considerably reduced only by addition of sodium alginate (about 60 per cent).

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EFEKAT FERIFEROCIJANIDA NA DEPOZICIJU ^{137}Cs KOD AKUTNE ORALNE KONTAMINACIJE U FUNKCIJI DOZE KONTAMINANTA I VREMENA NJEGOVE PRIMENE

Vojvodić S., *Stojadinović S.*

Institut za nuklearne nauke »Boris Kidrič« — Vinča
Medicinska zaštita

Vršeno je ispitivanje efikasnosti određene doze feriferocijanida (100 mg po pacovu) na depoziciju ^{137}Cs kod

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ZAŠTITA OD ZRAČENJA PRI KORIŠĆENJU X I GAMA ZRAČENJA U DEFEKTOSKOPIJI

Ristić Đ., Gnjatović S., Vuković S.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U referatu su opisane fizičke osobine Rö-aparata i radioaktivnih izotopa koji se koriste u defektoskopiji u našoj zemlji, vrste opasnosti pri njihovom korišćenju, vrste zaštitnih sredstava, proračun zaštite od rentgenskog zračenja i eksperimentalna provera i dozimetrijska kontrola.

RADIATION PROTECTION IN THE USE OF X AND GAMMA RAYS IN DEFECTOSCOPY

Institute of Nuclear Sciences, Vinča

The paper describes physical characteristics of the Roentgen apparatus and radioactive isotopes used in defectoscopy in our country, the kinds of hazards, the kinds of protection means, the protection calculation against roentgen and gamma rays, the experimental test and the dosimetric control.

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ZAŠTITA OD ZRAČENJA KOD PRIMENE RADIOAKTIVNIH SVETLEĆIH BOJA

Ristić Đ.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U referatu se razmatra primena radioaktivnih svetlećih boja u našoj zemlji, njihove karakteristike, problem radijacione zaštite, mere koje treba da se preduzmu u cilju zaštite od štetnog dejstva radioaktivnih svetlećih boja, medicinska i fizička kontrola.

RADIATION PROTECTION IN USING RADIACTIVE LAMINOUS PAINTS

Ristić Đ.

Institute of Nuclear Sciences, »Boris Kidrič« — Vinča

The paper deals with the use of radioactive luminous

paints in our country, their characteristics, radiation protection problem, measures to be undertaken to provide protection against the effect of radioactive luminous paints, medical and physical control.

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IZRAČUNAVANJE IONIZIRAJOČEGA SEVANJA IN POTREBNE ZAŠČITE PRED IONIZIRAJOČIM SEVANJEM BETATRONOV

Grgič M., Kristan J.

Nuklearni institut »Jožef Stefan«, Ljubljana

V referatu je podano izračunavanje ionizirajočega sevanja betatronov na osnovi poznavanja: (1) energije pospešnih elektronov, (2) toka (časovno povprečje) pospešenih elektronov in (3) razporeditive materialov v odnosu na pospeševalno cev. (Eventualne tarče, okence, kolimator, izravnalni, flter, obsevanec, telo betatrona, zaščitni zaslon žarka, in ostale stene betatronskega prostora.)

Z upoštevanjem zakona o ohranitvi energije je najprej ocenjena integralna rast doze [kg. rad/sek.]. Z upoštevanjem zakonov širenja in pretvarjanja ionizirajočega sevanja pri prehodu skozi snov pa je ocenjena prostorska porazdelitev rasti doze za posamezne oblike ionizirajočega sevanja.

Zaradi ilustracije je izračunavanje uporabljeno za betatron NIJS zato, da smo lahko primerjali rezultate izračunavanja z dejanskimi razmerami pri betatronu. Mislimo, da je takšno izračunavanje pomembno za razumevanje potreb zaščite pri betatronih in za projektiranje zaščite pri gradnji novih betatronov.

CALCULATIVE ESTIMATIONS OF IONIZING RADIATIONS AND THE NECESSARY SHIELDING FOR BETATRONS

Grgić M., Kristan J.

Nuclear Institute »Jožef Stefan« — Ljubljana

The given calculations are based on the knovledge of (1) the energy of the accelerated electrons, (2) the curent

of accelerated electrons (time average) and (3) the distribution of materials around the acceleration tube and the field of the primary beam.

Taking into account the conservation of energy the integrated dose rate (kg. rad/sek) may be estimated by converting the standard power units into integrated dose rate units. The spatial distribution of different ionizing radiation fields and dose rates are estimated taking into account the knowledge of different interactions of radiation with matter.

To illustrate the application of the calculations we have applied them to the NIJS betatron (B-B-C, 31 MeV). A comparisson is made of the estimated results with the actual conditions at the concerned betatron. We believe that such calculation are very useful for understanding of the shielding and other health protection measures for betatrons and also for designing of shielding for the future betatrons.

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VRUĆE ĆELIJE ZA ISPITIVANJE GORIVNIH ELEMENATA UO_2 POSLE OZRAČIVANJA

(Uslovi zaštite pri projektovanju vrućih ćelija)

Pavlović A., Dević J., Mihailović K.

Institut za nuklearne nauke »Boris Kidrič«, Vinča

U radu su obuhvaćeni uslovi koje treba da zadovolje vruće ćelije za ispitivanje gorivnih elemenata posle ozračivanja u reaktoru. Isto tako definisani su i uslovi za objekat u kome su smeštene vruće ćelije.

Dati su osnovni elementi i oprema vrućih ćelija. Obrađen je spoljni i unutrašnji transport. Postavljeni su uslovi za specijalnu ventilaciju, dozimetrijsku kontrolu i za specijalni tretman otpadnih voda.

HOT CELLS FOR THE INVESTIGATION OF UO_2 FUEL ELEMENTS AFTER IRRADIATION

(Project conditions for hot cells)

Pavlović A., Dević J., Mihailović K.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča

In this paper the conditions which hot cells should satisfy for the investigation of fuel elements after irradiation in reactor are included. Also the conditions are defined for the building where the hot cells are placed.

Basic elements and equipment of hot cells are given. External and internal transport is treated. Conditions for special ventilation, dosimetric control as well as special treatment of contaminated water are established too.

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INTEGRALNO OZRAČENJE PACIJENTA PODVRGNUTOG TELEGAMA TERAPIJI NA Co-60 UREĐAJU »JUPITER JUNIOR« SA ILI BEZ OBRAČUNAVANJA KOMPONENTE TERAPIJSKOG OZRAČENJA

Bistrović M., Konstantinović M., Kranjec M.

Zavod za onkologiju i radioterapiju kliničkog bolničkog centra, Zagreb Rebro

Na temelju slijedeće klasifikacije ozračenih subjekata:

1. nezračeni
2. profesionalno ozračeni
3. ozračeni u toku radioterapije
4. ozračeni u nepredviđenom udesu

pokušavamo usporediti naš subjekt iz treće klase sa subjektom iz druge i četvrte klase. U prvom slučaju uspoređujemo naš subjekt s onim koji prima 26 g puta r mjesečno, što bi odgovaralo gornjoj granici doze dozvoljenoj u klasi profesionalno ozračenih. U toj usporedbi pokušava-

mo eliminirati radioterapijsku dozno-volumnu komponentu ozračenja. S druge strane, uspoređujemo naš subjekt s onim iz četvrte klase, koju sada reprezentiramo sa 100 r po čitavom tijelu, što bi odgovaralo int. dozi od 7000 kg puta r, najnižoj dozi koja izaziva radijacijsku bolest. U ovoj posljednjoj usporedbi obračunavamo i dozno-volumnu komponentu radioterapijskog postupka.

THE INTEGRAL IRRADIATION OF PATIENT DURING TELEGAMMATHERAPY ON Co-60 UNIT JUPITER JUNIOR EXCLUDING OF INCLUDING THE THERAPEUTICAL IRRADIATION COMPONENT

Bistrović M., Konstantinović M., Kranjec M.

Institute of Oncology and radiotherapy Rebro-Zagreb

On the assumtion of the following classification of irradiated subject:

1. unirradiated
2. occupationally irradiated
3. irradiated during radiation therapy
4. irradiated in an accident event

we try to do a comparation of our subject belonging to the 3^{D} class with the subject belonging to the 2^{D} and 4th class. In the first case we compare our subject to the one irradiated with 26 g times r monthly, corresponding to the upper dose limit allowed to the occupationally irradiated. In this comparation we try to eliminate the dose (volume components of radiotherapeutical treatment. An other comparation of our subject is done to this one in the 4th class, chich is represented now with 100 r hole body dose, equivalent to 7000 kg times r, the lowest dose limit causing irradiation disease. In this last comparation the therapeutical dosis) volume components are taken into account too.

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GAMA SPEKTAR I DOZNA KONSTANTA ^{182}Ta

Ninković M.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U ovom radu prikazani su podaci o gama spektru ^{182}Ta, snimljenom na cilindričnom poluprovodničkom Ge(Li)-de-

tektoru, rezolucije oko 3 KeV na energijama ^{60}Co. Na osnovu eksperimentalno dobijene krive, za apsolutnu prostorno-energetsku efikasnost detektora i površina ispod pikova totalne apsorpcije, određeni su relativni i apsolutni prinosi gama linija u spektru.

Korišćenjem najnovijih literaturnih podataka, za koeficijente transfera energije gama zračenja u vazduhu i dobijenih vrednosti za apsolutne prinose, izračunate su parcijalne, grupne i totalna dozna konstanta.

GAMMA SPECTRUM AND DOSE CONSTANT ^{182}Ta

Ninković M.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča

The paper gives the data about gamma spectrum of ^{182}Ta, measured on the cylindrical semicoductor Ge(Li)-detector, with a resolution of 3 KeV for the energies of ^{60}Co. At the basis of the curve experimentally oblained, for an apsolute special-energetic efficiency of a detector and surfaces under total absorption peaks, the relative and absolute yields of gamma lines in the spectrum are determined.

By using the latest literature data, for the transfer coefficient of gamma-ray energy in the air and the obtained value for absolute yields, partials, groups and total dose constant are calculated.

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PRIKAZ RÖNTGEN — GAMMA DOSIMETER-a VA-J-15A

Križanović D., Tomašević M.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović«, Beograd

U radu je dat pregled karakteristika instrumenta VA-J-15A, mogućnost njegove primene pri merenju doza

X zračenja kao i neka zapažanja do kojih se došlo u toku rutinskog merenja kod medicinskih rendgen aparata.

Posebna pažnja je bila posvećena korelaciji vrednosti koje su dobijene pri merenju doza instrumentom VA-J-15A i komorama Victoreen.

PRESENTATION OF THE VA-J-154 ROENTGEN — GAMMA DOSIMETER

Križanović D., Tomašević M.

Institute of Occupational and Radiological Health
Beograd

The paper gives a review of the VA-J-154 characteristics, the possibilities for the use of the instrument tor the measurement of X-ray doses, and it also reports on some observations arrived at in the course of routine measurements with medical roentgen apparatuses.

Special attention has been paid to the correlation of values obtained during the measurement of doses with the VA-J-154 instrument and the Victoreen chambers.

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PRENOSNI INSTRUMENTI ZA MERENJE JAČINE EKSPOZICIONE DOZE X I GAMA ZRAČENJA

Muždeka S., Mirić P., Šobajić M., Blagojević R.

Institut za nuklearne nauke» Boris Kidrić«, Vinča
Beograd

Opisani su razvijeni prenosni instrumenti namenjeni za merenje jačine ekspozicione doze X i gama zračenja. Kao detektori zračenja upotrebljene su jonizacione komore.

Instrument za merenje X zračenja ima prozor debljine 12 mgr/cm^2 i merne opsege 20 mR/h, 200 mR/h, 2 R/h i 20 R/h. Instrument za merenje gama zračenja ima šest linearnih mernih opsega: 10 mR/h, 100 mR/h, 1 R/h, 10 R/h, 100 R/h i 1000 R/h.

PORTABLE EXPOSURE RATE METERS FOR X AND GAMMA RADIATIONS

Muždeka S., Mirić P., Šobajić M., Blagojević R.

Institute of Nuclear Sciences »Boris Kidrič«, Vinča
Beograd

Portable instruments for measuring the exposure rate of X and gamma radiations are described. Ionization chambers were used as radiation detectors.

The instrument for X radiation measurement has a window 12 mg/cm^2 thick and measuring ranges of 20 mR/h, 200 mR/h, 2 R/h and 20 R/h. The instrument for gamma radiation measurement has six linear measuring ranges: 10 mR/h, 100 R/h, 1 R/h, 10 R/h, 100/h and 1000 R/h.

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PRENOSNI MERILNIK SEVANJA GAMA SGM 2300

Glavič B., Cotman K., Kelšin D.

Nuklearni institut »Jožef Stefan«, Ljubljana

Delo z materiali, ki sevajo, zahteva hitro, enostavno, zanesljivo, občutljivo in priročno meritev, ki naj pove s kako veliko dozo imamo opraviti. Razvili smo monitor s fotopomnoževalko, scintilacijskim kristalom (NaJ-Tl) in logaritmičnim potekom skale. Si-diode, s katerimi dobimo logaritemsko odvisnost preko treh dekad, so temperaturno odvisne (cca 3mV/^{0}C). S toplotno občutljivim NTK uporom premikamo avtomatsko delovni prag Si-diod in delovno točko MOSFET transistorja tako, da je celoten ojačevalni sistem temperaturno neobčutljiv. Aparat je zato brez zunanjih regulacij občutljivosti in kontrole drifta, kar uvršča monitor med boljše instrumente.

SGM 2300, A POTABLE MONITOR FOR GAMMA RADIATIONS

Glavić B., Cotman K., Kelšin D.

Nuclear Institute »Jožef Stefan« — Ljubljana

The work with radioactive materials postulates a quick, simple, reliable and sensitive measurement of dose-rate. The described monitor uses NaJ(Tl) scintilation crystal and logarithmic scale: The performances of Si-diodes, used are temperature dependent (cca 3 mV/°C). This is compensated and eliminated by NTK resistor for automatic adjustment of working range of Si-diodes and of the working level of the MOSFET transistors, so the amplifient systems are temperature unimfluenced. The monitor doses not need any additional manual readjustments and has no other, but only the on-off switch. All this features allow us to point out its high performance qualities.

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O NEKIM MERENJIMA U POLJU SEKUNDARNOG ZRAČENJA

Hrovat J.

Zavod za varstvo pri delu — Ljubljana

Merena su sekundarna zračenja koja izlaze iz čelika kod ozračivanja čelika primarnim zracima Co-60. Ir-192 i Cs-137.

Data je zavisnost doze sekundarnog zračenja od veličine eksponirane površine, debeline materijala i pravca.

Data je energetska razdeoba zračenja u pojedinim pravcima sa posebnim obzirom na problem nošenja zaštitnih kecelja kod gama defektoskopije.

ON SOME MEASUREMENTS IN THE SECONDARY RADIATION FIELD

Hrovat J.

Institute for Work protection — Ljubljana

Measurements have been made of the secondary radiations from steel during the irradiation of steel by primary rays of Co-60, Ir-192 and Cs-137.

The paper reports on the dependancy of the dose of secondary radiation upon the extent of the exposed surface. the thickness of the material and the direction.

It also provides a power distribution of radiation in various directions with special regard to the problem of wearing protective aprons in gamma defectoscopy.

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O DEFINICIJI IZVORA SEKUNDARNIH ZRAČENJA

Sterle M.

Zavod za varstvo pri delu — Ljubljana

Svako telo koje se nalazi u snopu primarnog zračenja postaje izvor sekundarnih zračenja. Takvo telo ima čitavo vreme ekspozicije neku fiktivnu radioaktivnost.

Ta fiktivna radioaktivnost zavisi od brzine doze zračenja kojom je telo eksponirano, energije primarnog zračenja, dimenzije (površine i volumena tela, odnosno širine snopa primarnog zračenja), materijala ozračenog tela, i pravca sekundarnog zračenja.

Dat je predlog za izradu tabela, a sve na osnovu eksperimentalnih merenja, koje bi služile za definiciju »fiktivne radioaktivnosti« i izračun doza sekundarnog zračenja.

ON THE DETERMINATION OF HARDNESS OF IRRADIATION BY AID OF FILMDOSIMETERS

Sterle M.

Institute for Work protection — Ljubljana

Each body in a beam of primary radiation becomes a source of secondary radiation. Such a body has during all the time of the exposition some fictitious radioactivity.

This fictitious radioactivity depends upon the velocity of the radiation dose at which the body is exposed. the energy of the primary radiation, the sizes involved (surface and volume of the body, i.e. the breadth of the beam of the primary radiation), the material of the irradiated body, and the direction of the secondary radiation.

A proposal follows for the drawing up of tables founded on the experimental measurements, which would serve for the definition of the »fictitious radioactivity«, and the calculation of the dose of the secondary radiation.

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MOGUĆNOSTI MERENJA NISKIH I VISOKIH DOZA TERMOLUMINISCENTNIM DOZIMETRIMA

Petrović D.

Institut za medicinu rada i radiološku zaštitu

»Dr Dragomir Karajović«, Beograd

Ovo saopštenje ima karakter upoznavanja o mogućnostima dozimetrije u oblasti visokih i niskih doza sa termoluminiscentnim dozimetrima. Cela ova oblast je data pretežno kao literaturni rad, odnosno pregled, dok su sopstveni rezultati izneti u oblasti niskih doza (oko 1 mR) sa literaturnim vrednostima.

Na kraju iz ovih prikaza izvučen je zaključak i program rada u ovoj oblasti.

POSSIBILITIES OF MEASURING LOW AND HIGH DOSES WITH THERMOLUMINESCENT DOSIMETERS

Petrović D.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović — Beograd

This observation has a character of acquaintance with possibilities of dosimetry in the field of high and low doses with thermoluminescent dosimeters. All this field is given predominantly theoretically i.e. as a review but, own results in the line of low doses (about 1 mR) are given compared with the values stated in the literature.

At the end the conclusion and the program of action are drawn out from this review.

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PROVJERA ZAŠTITE KOD ZATVORENIH IZVORA

Cerovac H., Benčak Z., Hufnus R.

APSTRAKT NIJE DOSTAVLJEN

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PREGLED ZAŠTITE DIJAGNOSTIČKIH RENDGEN APARATA

Cerovac H., Benčak Z., Hufnus R.

APSTRAKT NIJE DOSTAVLJEN

DOZVOLJENE GREŠKE MERENJA DOZA I BRZINA DOZA U AKCIDENTALNIM I VANREDNIM SITUACIJAMA

Vojvodić V.

VP 6869 Beograd

Iz raspoloživih statističkih podataka određena je kriva oboljenja i smrtnosti skupa ljudi u funkciji jednokratne akutne akumulirane doze. Na osnovu procene skupa, prema ovim krivama, pri medialnim dozama 200 i 450 r određena je maksimalna relativna greška dozimetara, koja ne bi smela biti veća od ± 5—10%. Preporučuje se da se baždarenje vrši na 200 i 450 r u polju zračenja koje najviše simulira očekivanu akcidentalnu i vanrednu situaciju.

PERMISSIBLE MEASURE — ERRORS OF DOSES AND DOSE RATES IN ACCIDENTAL AND EXCEPTIONAL SITUATIONS

Vojvodić V.

VP 6869 — Beograd

From the existing statistical data curve of sickness and mortality of a men-group in the function of single acute dose is determined. On the basis of group estimation, according to these curves, by medial doses 200 and 450 r the maximum relative error of dosimeter is determined; it has not to be bigger than ± 5—10%. It is recommended calibration of the instruments to be done at 200 and 450 r in radiation field that maximally simulates the expected accidental or exceptional situations.

KPRITIČKE OCENE DOZVOLJENIH NIVOA RADIOAKTIVNE KONTAMINACIJE BIOSFERE SA Cs-137 i Sr-90

Radovanović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

Polazeći od maksimalno dozvoljenih doza zračenja koje uslovljavalju inkorporirani radionuklidi u pojedinim organima ili celom ljudskom organizmu, moguće je na osnovu modela diskriminacionih faktora ili modela depozicije ustanoviti maksimalno dozvoljeni nivo radioaktivne kontaminacije biosfere pojedinim radonuklidima.

Realna kontaminacija biosfere izvršena je smešom fisionih produkata, od kojih su Cs-137 i Sr-90 najznačajniji. Odnos udela Cs-137 i Sr-90 u internoj kontaminaciji ljudi nije uvek, na svim terenima i za sve ljude, isti. Zbog toga nivo radioaktivne kontaminacije biosfere, koji se može smatrati dozvoljenim, sa ovim izotopima nije jedinstven.

CRITICAL ASSESSMENT OF PERMISSIBLE LIVELS OF RADIOACTIVE CONTAMINATION OF BIOSPHERE BY Cs-137 AND Sr-90

Radovanović R.

Institute of Occupational and radiological Health
»Dr Dragomir KParajović« — Beograd

Starting from maximum permissible doses of radiation which are conditioned by incorporated radionuclides in individual organs or whole human body, it is possible according to a model of discrimination factors or model of deposition to establish maximum permissible level of radioactive contamination of biosphere by individual radionuclides.

A real contamination of biosphere was performed by mixture of products of fission from which Cs-137 and Sr-90 are the most significant. Cs-137 and Sr-90 share ratio in internal contamination of men is not always, on all fields and for all men, the same. Therefore, the level of radioactive contamination of biosphere, which could be considered as permissible, is not unique with these isotopes.

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RADIOKONTAMINACIJA SVEŽEG GOVEĐEG I SVINJSKOG MESA U USLOVIMA SPOLJAŠNJE KONTAMINACIJE RADIONUKLIDIMA ^{131}J i ^{137}Cs

Petrović V., Kralj J., Stanković S., Petrović B.

Institut za primenu nuklearne energije u poljoprivredi, veterinarstvu i šumarstvu — Zemun

Veterinarski fakultet — Sarajevo

Aktuelnost i značaj radijaciono-higijenske ocene kontaminiranih domaćih životinja i njihovih proizvoda orijentisali su nas da sistematski ispitamo problem spoljašnje radiokontaminacije goveđeg i svinjskog mesa sa ^{131}J i ^{137}Cs.

Zadatak ovog rada je da ispita:

1. da li hidrosolubilni radionuklidi Cs-137 (u obliku CsCl 137) i J-131 (u obliku Na JO_3-131), posle spoljašnje kontaminacije prodiru u dublje slojeve mesa,

2. koliko stepen i obim penetracije kontaminanta zavisi od momenta nastajanja i trajanja kontaminacije, i

3. da li i koliko utiču promene u mesu u toku 48. časovnog zrenja na stepen, obim i brzinu prodiranja kontaminanta.

U daljem izlaganju autori ukazuju na mogućnost praktične primene svojih rezultata.

RADIOCONTAMINATION OF RAW BEEF AND PORK AFTER THE EXTERNAL CONTAMINATION BY RADIONUCLIDES ^{131}I and ^{137}Cs.

Petrović V., Kralj J*., Stanković S*., Petrović B*.*

The actuality and importance of radiation-hygienic assessments of contaminated farm animals and their products directed us to a systematical examination of the problem of external radiocontamination of beef and pork with ^{131}I and ^{137}Cs.

The aim of this work was to find out:

1. whether the watersoluble radionuclides ^{137}Cs (like $^{137}CsCl$) and ^{131}I (like $Na^{131}IO_3$) penetrate into the inner layers of meat after external contamination.

2. how much does the degree and range of penetration by the contaminants depend on the moment of arising and duration of contamination, and

3. whether and how much do the changes in the meat influence the degree, range and speed of penetration of the contaminants during a 48 hour ripening.

In their further comments the authors point out the possibility of the practical use of their results.

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* Petrović Vladimir, Veterinary, INEP, Zemun, Baranjska 15

* Dr Josip Kralj, Professor, Veterinary Faculty, Sarajevo

* Slobodanka Stanković, Mr. SC., Assistant — INEP, Zemun Baranjska 15

* Dr Branislav Petrović- Scientific Collaborator, INEP, Zemun, Baranjska 15

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RADIOAKTIVNA KONTAMINACIJA LJUDSKIH KOSTIJU STRONCIJUMOM-90 U SARAJEVU I OKOLINI

Čustović F.

Institut za preventivnu i socijalnu medicinu — Sarajevo

Velike količine Sr-90 nađene u atmosferi i hrani u toku 1963/64 godine navele su autora da ispita količinu

Sr-90 deponovanog u ljudskim kostima uopšte a naročito u kostima male dece u Sarajevu i okolini u periodu od 1963 do 1968. godine

Prema rezultatima ispitivanja Sr-90 u 57 uzoraka ljudskih kostiju različite starosti, autor je došao do zaključka da se najveća količina Sr-90 može naći u starosnoj grupi od 0—4 god.

Ako pretpostavimo da će deca rođena 1963, 1964 i 1965. imati količinu Sr-90 u kostima sličnu onoj kod ispitivanih uzoraka i pretpostavljajući da neće više biti eksplozije, izračunata je doza Sr-90 deponovanog u kostima te dece kad navrše sedamdeset godina starosti. Ta doza za decu rođenu 1963. god. iznosila bi 242,20 mrem.

RADIOACTIVE CONTAMINATION OF HUMAN BONES WITH STRONTIUM-90 IN SARAJEVO AND ITS SURROUNDING

Čustović F.

Institute for Preventive and Social Medicine — Sarajevo

Large amounts of Sr-90 found in atmosphere and in food during 1963 and 1964 has lead the author to investigate the amount of Sr-90 deposited in human bones in general and especially in bones of small children in Sarajevo and its surroundings during the period of 1963—1968 year.

According to the results of investigation of Sr-90 in 57 samples of human bones of different age, the author has come to the conclusion that in the age group of 0—4 years the largest amounts of Sr-90 can be found.

Assuming that the children born in 1963, 1964 and 1965 will have a similar amount of Sr-90 in bones to that of the investigated samples and assuming that there will be no more explosions a 70-year bone dose to be created by Sr-90 deposited in their bones has been calculated. The 70-year bone dose of Sr-90 to children born in 1963 would amount to 242,20 mrem.

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RADIOAKTIVNOST FOLAUTA NA TERITORIJI INSTITUTA ZA NUKLEARNE NAUKE »BORIS KIDRIČ«

Tasovac T., Radosavljević R., Kovačević M., Đorđević D., Vujović V.

Institut za nuklearne nauke »Boris Kidrič«

Utvrđene su zakonitosti deponovanja folauta i razmatrana je distribucija ukupne beta radioaktivnosti između čvrste i tečne faze padavina u dužem vremenskom periodu na teritoriji Instituta za nuklearne nauke »Boris Kidrič«.

RADIOACTIVITY OF FALLOUT ON THE TERRITORY OF THE »BORIS KIDRIČ« INSTITUTE OF NUCLEAR SCIENCES

Tasovac T., Radosavljević R., Kovačević M., Đorđević D., Vujović V.

Nuclear Science Institute »Boris Kidrič« — Vinča
Beograd

As part of the program for the radioactivity investigation of the territory of the »Boris Kidrič« Institute of Nuclear Sciences and the acumulation of radioactive nuclides in different ecologic components, systematic study of the radioactivity of fallout, was carried out. The regularity of deposition and fallout distribution between solid and liquid phase are analyzed.

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UKUPNA BETA RADIOAKTIVNOST U VAZDUHU U PERIODU 1962—1968 GOD. U SRS

Vukotić M., Radovanović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« Beograd

U radu su prezentirani rezultati merenja ukupne beta radioaktivnosti atmosferskog vazduha u tri punkta na te-

ritoriji SRS: Beograd, Zaječar, Subotica (Palić).

Rezultati merenja pokazuju da su najveće koncentracije registrovane 1962. godine, sa tendencijom opadanja narednih godina.

TOTAL BETA RADIOACTIVITY IN AIR IN THE PERIOD OF 1962—1968 IN S.R. SERBIA

Vukotić M., Radovanović R.

Institute of Occupational and Radiological Health »Dr Dragomir Karajović« — Beograd

In the paper the results of the measurements of total beta radioactivity of atmospheric air in three points on territory of S.R. Serbia: Beograd, Zajećar and Subotica (Palić) are presented.

The results of the measurements show the highest concentrations were registered in 1962 with a tendency towards decrease in next to come years.

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MERENJE NISKIH BETA RADIOAKTIVNOSTI PRIMENOM POLUPROVODNIČKIH DETEKTORA

Kostić S., Muždeka S., Ćirilov B. Smelcerović M.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Rutinska merenja niskih nivoa beta aktivnosti koriste se obično za brojanje 1 do 10 impulsa/min.

Antikoincidentne metode sa GM brojačima zahtevaju oklapanje olovom i čelikom.

Dosadašnji razvoj poluprovodničkih detektora pogodan je za isti tip merenja jer se dobijaju uporedivi rezultati u pogledu fona i efikasnosti, bez upotrebe olovnih oklopa, uz niže napone, stabilnija elektronska kola, mogućnost energetske diskriminacije i veće brzine brojanja.

MEASUREMENT OF LOW-LEVEL BETA RADIOACTIVITIES USING SEMICONDUCTOR DETECTORS

Kostić S., Muždeka S., Ćirilov B.
Šmelcerović M.

Nuclear Sciences Institute »Boris Kidrič« — Vinča
Beograd

Routine measurements of low-level beta activities are usually performed for counting 1 to 10 counts per minute.

Anticoincidence methods with GM counters require shielding with lead and steel.

The so-far development of semi-conductor detectors is suitable for the same measumerents because comparable results for background and efficiency are obtained, without the use of lead shielding, with low voltages, more stable electronic circuits, a possibility of energy discrimination and higher counting rates.

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MOGUĆNOST BRZE REGISTRACIJE RADIOAKTIVNIH PADAVINA U ATMOSFERI U PRISUSTVU PRIRODNIH RADIOAKTIVNIH ELEMENATA NA OSNOVU NJIHOVIH KRIVULJA RASPADA

A. *Teoretska razmatranja*

Bistrović M., Picer M., Popović V.

Klinički bolnički centar, Zagreb

i

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

U toku postupka mjerenja faktor raspada F bilo zadrži početnu vrijednost 1, ako postoji kontaminacija fisionim produktima, ili je manji od 1, ako ovih produkata nema. Neka je F' rezultat jednog pojedinačnog mjerenja. Autori

pokušavaju naći koliko neki mjereni F' može da da pozitivan odgovor na pitanje »Ima li fisionih produkata u atmosferi?«.

F'-ovi su kao rezultati mnogih mjernih postupaka normalno raspoređeni bilo oko F, bilo oko 1, ovisno o tome da li je DA ili NE odgovor na pitanje »Da li ima?«. Pomoću dviju funkcija distribucije DA(F') i NE(F') definira se funkcija pouzdanosti R(F') ovako

$$R(F') = DA(F')/NE(F')$$

gdje je F' neki pojedinačni rezultat jednog mjernog postupka. Funkcija R(F') ima eksponencijalnu formu i za svaki F' nam kaže koliko je odgovor DA vjerojatniji od odgovora NE. Funkcija R(F') se superponira multiplikativno, tako da dva uzastopna rezultata F'_1 i F'_2 daju $R = R(F'_1) \times R(F'_2)$.

Autori također pokušavaju da procijene eksperimentalne uvjete za najkraće vrijeme mjernog postupka.

A POSSIBILITY OF FAST DETERMINATION OF RADIOACTIVE FALL-OUT IN THE ATMOSPHERE IN THE PRESENCE OF NATURAL RADIOACTIVE ELEMENTS ON THE BASIS OF THEIR DECAY CURVES

A. *Theoretical Considerations*

Bistrović M., Picer M., Popović V.

Institute for Clinical Oncology and Radiotherapy, Medical Faculty, University of Zagreb
and
Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

During the measuring procedure the decay factor F either retains its initial value 1, if fission product contaminations exists, of becomes less than 1, if the contamination does not exist. Let F' be the result of one individual measuring procedure. The authors are trying to find out to what extent a measured F' can give a positive answer to the question »Are there fission products in the atmosphere?«.

The results of many measuring procedures F' are normally distributed either around F or around 1, depending

on whether YES od NO is the answer. By means of two distribution functions YES (F') and NO (F') the function of reliability R (F') is defined as

$$R(F') = YES(F')/NO(F')$$

where F' is any individual result of one measuring procedure. The function R(F') has the exponential from, and for each F' provides information about how many times the YES answer is more probable than the NO answer. The function R(F') is superposed multiplicatively, two successive results F'_1 and F'_2 thus giving $R = R(F'_1) \times R(F'_2)$.

The authors also try to evaluate the experimental conditions for the shortest measuring time.

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MOGUĆNOST BRZE REGISTRACIJE RADIVOAKTIVNIH PADAVINA U ATMOSFERI U PRISUSTVU PRIRODNIH RADIOAKTIVNIH ELEMENATA NA OSNOVU *NJIHOVIH KRIVULJA RASPADA*

B. *Eksperimentalna provjera teoretskih razmatranja*

Popović V., Picer M., Bistrović M.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

i

Klinički bolnički centar, Zagreb

Radi evaluacije teoretskih razmatranja prikazanih u prethodnom članku vršena su mjerenja početne radioaktivnosti i praćen je radioaktivni raspad smjese prirodnih radionuklida reteniranih na filtrir papiru nakon prosisavanja izvjesne količine zraka kroz filtrirajući sistem.

Na temelju dobivenih rezultata mjerenja diskutiran je utjecaj vremena prosisavanja, brojenja i razmaka između pojedinih brojenja te nivo prirodne radioaktivnosti na duljinu i tačnost metode brze detekcije svježih radioaktivnih padavina u atmosferi. Dobiveni rezultati mjerenja uspoređeni su sa rezultatima teoretskih razmatranja.

A POSSIBILITY OF FAST DETERMINATION OF RADIOACTIVE FALL-OUT IN THE ATMOSPHERE IN THE PRESENCE OF NATURAL RADIOACTIVE ELEMENTS ON THE BASIS OF THEIR DECAY CURVES

B. *Experimental Checking of Theoretical Considerations*

Popović V., Picer M., Bistrović M.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zegreb

and

Institute for Clinical Oncology and Radiotherapy, Medical Faculty, University of Zagreb, Zagreb

To evaluate theoretical considerations presented in the preceding article measurements of initial radioactivity were performed and decay of a mixture of natural radionuclides retained on filter paper after pumping a certain quantity of air through the filtering system was studied.

On the basis of the results obtained the effect of the duration of pumping and of intervals between the two successive countings as well as of the level of natural radioactivity on the length and accuracy of the method are discussed. The results of measurements are compared to the results of theoretical considerations.

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RADIOAKTIVNOST RASTINJA NA TERITORIJI INSTITUTA ZA NUKLEARNE NAUKE »BORIS KIDRIČ«

Tasovac T., Radosavljević R., Vujović V., Kovačević M., Đorđević D.

Institut za nuklearne nauke »Boris Kidrič«

U okviru redovnog programa kontrole okoline Instituta za nuklearne nauke »Boris Kidrič« u periodu od

1962—1967. g. sistematski su ispitivani totalna beta radioaktivnost rastinja, sadržaj K^{40} i Cs^{137}. Analizirane su promene radioaktivnosti sa mestom i vremenom.

RADIOACTIVITY OF PLANTS ON THE TERRITORY OF THE BORIS KIDRIČ INSTITUTE OF NUCLEAR SCIENCES

Tasovac T., Radosavljević R., Vujović V., Kovačević M., Đorđević D.

»Boris Kidrič« Institute of Nuclear Sciences

As part of the survey program of the Boris Kidrič Institute of Nuclear Sciences in the period 1962—1967, systematic investigation of the radioactivity of plants, potassium — 40 and cesium — 137, was carried out. Changes of the radioactivity of samples with time and places are analyzed.

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Cs-137 U PADAVINAMA I ŽIVOTINJSKIM KOSTIMA

Radovanović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

U periodu od 1955 do 1968. godine u okolini Beograda deponovano je sa padavinama oko 82 mCiCs-137/km^2.

Najviše Cs-137 deponovano je 1963. godine (21,1 mCi/km^2).

Na osnovu merenja koncentracija ovog izotopa u mesu i životinjskim kostima u toku 1967 i 1968. godine njihov ustanovljeni odnos iznosi 1,1.

Najveća koncentracija Cs-137 izmerena je u dugim kostima krava (95,5 pCi/kg).

Ustanovljeni diskriminacioni faktor (pCi/grK-kosti/ /pCi/grK-hrana) iznosi za krave 1,76—2,39.

Cs-137 IN FALLOUT AND ANIMAL BONES

Radovanović R.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović« Beograd

In the period from 1955 to 1968 about 82 mCi of Cs-137/km^2 was deponed with fallout in Beograde surroundings. The most of Cs-137 was deponed in 1963 (21,1 mCi/km^2).

According to the measurement of this isotope concentrations in meat and animal bones during 1967 and 1968 their founded ratio amount to 1,1.

The highest concentration of Cs-137 was measured in the long-bones of cows (95,5 pCi/kg).

Founded discrimination factor (pCi/grK-bones/pCi/ /grK-food) for cows is 1,76—2,39.

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FAKTORI DISKRIMINACIJE Sr-90/Ca U ZUBIMA LJUDI U ODNOSU NA SADRŽAJ Sr-90 U PIJAĆOJ VODI

Čustović F., Topić B.

Institut za preventivnu i socijalnu medicinu — Sarajevo

U ovom radu diskutuje se način prodiranja Sr-90 u zubno tkivo, njegova akumulacija i raspodela. Akumulacija Sr-90 u rastućim delovima ljudskih zuba zavisi od intenziteta metaboličkih procesa određenog doba starosti kao i od količine Sr-90 u biosferi.

Autori ovog rada želeli su da odrede i uporede količinu akumuliranog Sr-90 u zubima dece istog starosnog doba i različite količine Sr-90 u pijaćoj vodi. U tu svrhu odabrana su dva regiona u Hercegovini sa različitim vrstama pijaće vode (izvorska voda i kišnica skupljana je u cisternama) tj. sa različitim količinama Sr-90.

Posle vrlo jasnih indikacija prvi stalni molari ekstrahovani su deci od 7—12 god. u Lištici i okolnim selima.

Rezultati ovih ispitivanja koja su obavljena u toku školske godine 1967/68 pokazuju da je u korenovima prvih stalnih molara dece stare od 7—12 godina koja su rođena u selima oko Lištice akumulisana najveća količina Sr-90.

Koeficijent korelacije između Sr-90 u zubima i u pijaćoj vodi — kišnici je + 0,98, što dokazuje da korelacija postoji. Ova činjenica je pobudila autore da odrede odnose količine Sr-90/Ca u korenovima prvih stalnih molara i u kišnici koja je korišćena kao pijaća voda. Ovaj zapaženi odnos ljudski zubi — pijaća voda — kišnica je 0,73.

DISCRIMINATION FACTORS OF Sr-90/Ca IN HUMAN TEETH COMPARED TO CONTAINS OF Sr-90 IN DRINKING WATER

Čustović F., Topić B.

Institute for Preventive and Social Medicine — Sarajevo

The way of Sr-90 entering dental tissue, its accumulation and division are discussed in this paper. Accumulation of Sr-90 in growing parts of human teeth depends on intensity of metabolic processes of certain age as well as on amounts of Sr-90 in biosphere.

The authors of this paper wanted to compare and decide upon the amount of accumulated Sr-90 in teeth children of the same age and different amounts of Sr-90 in drinking water. For this purpose two regions in Hercegovina were chosen, with different kinds of drinking water (wells and rain-water collected in cisterns) i.e. with different amounts of Sr-90.

After a very definite indication, the first permanent molars were extracted with children aging 7—12 years at Lištica and surrounding villages.

The results of these investigations which were done during 1967/68 school year show that the roots of first permanent molars with children aging 7—12 years, who were born at villages around Lištica accumulated greatest amounts of Sr.90.

Coefficient of correlation between Sr-90 in human teeth and in drinking water — rain water is + 0,98 which

proves that the correlation exists. That fact made the authors determine relations of amount of Sr-90/Ca in roots of first permanent molars and rain-water used as drinking water. This observed relation human teeth — drinking water — rain water is 0,73.

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RAČUNANJE NEUTRONSKIH DOZA ZA VAZDUŠNU NUKLEARNU EKSPLOZIJU

Ćirić V.

Republički sekretarijat za narodnu odbranu, Beograd

Biološko dejstvo neutrona, koje emituje nuklearna (fisiona) eksplozija, zavisi od spektra energija i integralnog broja neutrona koji dospevaju na površinu zemlje.

U radu je prikazan postupak teorijskog proračuna neutronskog fluksa odnosno doza na različitim rastojanjima od centra eksplozije. Obraćena je posebna pažnja doprinosu naknadnih neutrona, uzimajući u obzir uticaj šupljine koja se javlja oko centra eksplozije.

Priloženi su numerički i grafički podaci o nivoima neutronskih doza za rastojanja od 200—3.500 m za vazdušnu nuklearnu eksploziju snage 20 kt.

CALCULATION OF NEUTRON DOSES FOR NUCLEAR EXPLOSION IN AIR

Ćirić V.

Republic Ministry of National Defence of S.R. Serbia, Beograd

The biological effect of neutrons emitted by nuclear (fission) explosion depends on the spectrum of energies and the integral number of neutrons reaching the ground surface.

A procedure for the theoretical calculation of the neutron flux, i.e. doses at different distances from the centre

of explosion, is presented. The yield of delayed neutrons has been particularly considered, taking into account the effect of the cavity which appears around the centre of explosion.

Numerical and graphical data on neutron dose levels at distances of 200—3500 m for an air burst of 20 kt. are given.

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PREVENTIVNE MERE I POSTUPAK U SLUČAJU AKCIDENATA SA RADIOAKTIVNIM GROMOBRANOM

Ristić Đ.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Rad sadrži kratak opis radioaktivnog gromobrana koji se koristi u Jugoslaviji sa topografijom jačine ekspozicionih doza oko njega u uslovima korišćenja; opasnosti koje se mogu očekivati u slučaju akcidenata; preventivne mere preduzete i koje treba preduzeti u slučaju pada gromobrana usled nepredviđenih jakih potresa (napad iz vazduha, zemljotres, vetar i sl.) kao i u slučaju požara na objektu na kome je gromobran postavljen.

PREVENTIVE MEASURES AND PROCEDURE IN A CASE OF RADIATION ACCIDENTS WITH A RADIOACTIVE LIGHTNING CONDUCTOR

Ristić Đ.

»Boris Kidrič« Institute of Neclear Sciences, Vinča

The paper gives a brief description of the radioactive lightning-conductor used in Yugoslavia, with a dose exposure topography around it, the dangers expected in case of an accident, the preventive measures undertaken and to be undertaken in case of the fall of the lightning-conductor

caused by an unexpected strong shake (wind, earthquake, bombardment etc.) as well as in case of a fire on the building on which the lightning-conductor is placed.

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INTERAKCIJA Mn^{54} S NEKIM ANORGANSKIM ČESTICAMA U MEDIJU MORSKE VODE

Picer M., Šilipetar-Picer N.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

Radi relativno male mogućnosti izotopnog razređenja Mn^{54} u morskoj sredini te zbog visoke koncentracijske sposobnosti mnogih morskih organizama prema neaktivnom manganu, vjeruje se da Mn^{54} ima veliku potencijalnu opasnost s obzirom na kontaminaciju morskih organizama a time i čovjeka.

Radi boljeg poznavanja interakcije Mn^{54} s morskim sedimentom, istraženi su slijedeći fenomeni vezani uz procese sorpcije i desorpcije Mn^{54} s krute faze:

1. Istražen je utjecaj vrste i načina kontaminacije morske vode kao i njezin pH na veličinu sorpcije Mn^{54} na raznim krutim fazama,
2. Prikazane su izoterme sorpcije Mn^{54} iz sintetske i ultrafiltrirane morske vode na morskom sedimentu, vapnencu i kvarcu,
3. Proučavana je desorpcija Mn^{54} s morskog sedimenta, vapnenca i kvarca prilikom miješanja umjetno kontaminirane krute faze s morskom vodom prirodne i povišene koncentracije vodikovih iona.

INTERACTION OF Mn^{54} WITH SOME INORGANIC PARTICLES IN THE SEA WATER MEDIUM

Picer M., Šilipetar-Picer N.

Institute for Medicl Research, Yugoslav Academy of Sciences and Arts, Zagreb

With regard to the relatively small possibility of isotope dilution of Mn^{54} in the sea medium and to the high

concentration capacity of many sea organisms towards non-active manganese, it is believed that Mn^{54} represents a great potential hazard of contamination for sea organisms as well as humans.

To get more information about the interaction of Mn^{54} with the sea sediment, the following phenomena related to the process of Mn^{54} sorption and desorption from the solid phase have been studied:

1. The effect of the type and way of contamination of sea water and its pH on Mn^{54} sorption by various solid phases,

2. Isotherms of the sorption of Mn^{54} by the sea sediment, limestone and quartz in synthetic and ultrafiltered sea water,

3. Mn^{54} desorption from the sea sediment, limestone and quartz during the mixing of artifically contaminated solid phase with sea water containing natural and higher concentrations of hydrogen ions.

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SORPCIJA RADIONUKLIDA ^{137}Cs, ^{89}Sr i ^{60}Co NA IZABRANIM UZORCIMA POVRŠINSKOG SLOJA ZEMLJE

Knežević Lj., Janković-Gaćinović O.

Institut za nuklearne nauke »Boris Kidrič«, Vinča

Ispitana je sorpcija radionuklida ^{137}Cs, ^{89}Sr i ^{60}Co, u statičkim uslovima, na uzorcima površinskog sloja zemlje u zavisnosti od pH rastvora, vremena kontakta, početne koncentracije atsorbovanih katjona i koncentracije $CaCl_2$ kao makrokomponente. Određeni su kapaciteti sorpcije uzoraka zemlje u odnosu na jone Na^+ i Ca^{++}. Određeni su distribucioni koeficijenti (Kd) i redosled afiniteta prema svim uzorcima zemlje bio je sledeći:

$$Co^{++}\ Cs^{+}\ Sr^{++}$$

SORPTION OF RADIONUCLIDES ^{137}Cs, ^{89}Sr AND ^{60}Co ON SURFACE BED OF SOME SELECTED SOILS

Knežević Lj., Janković-Gaćinović O.

Institute of Nuclear Sciences »Boris Kidrič« — Vinča

The sorption of radionuclides ^{137}Cs, ^{89}Sr, and ^{60}Co on surface bed of some soil samples was investigated under batch conditions in dependence on the pH of solution, contact time, initial concentration of adsorbed cations and concentration of a competing macrocomponent as $CaCl_2$. The sorption capacities of soil samples with respect to Na^{+} and Ca^{++} were determined. Distribution coefficients (Kd) were determined and the following sequence of affinity all samples was noticed:

$$Co^{++} > Cs^{+} > {}^{++}$$

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UTICAJ DIJAGNOSTIČKIH DOZA X-ZRAČENJA NA HUMANE HROMOZOME

Pendić B., Lovrić Lj., Plećaš V., Dragović M.

Gradska bolnica Beograd

U radu su prikazani rezultati citogenetskih ispitivanja ćelija periferne krvi u pacijenata u kojih je x-zračenje upotrebljeno za dijagnostičko ispitivanje gastrointestinalnog trakta.

Ovaj preliminarni rad ukazuje da hromozomske anomalije mogu da budu uzrokovane relativno niskim dozama zračenja koje se upotrebljavaju u dijagnostičke svrhe.

Kao kontrola poslužile su kulture ćelija učinjene pre zračenja.

Učestanost hromozomskih aberacija posle dijagnostičkog ozračivanja, u odnosu na preiradijacionu kontrolu, je znatna, posebno porast aneuploidnih ćelija.

EFFECTS OF DIAGNOSTIC X — IRRADIATION ON HUMAN CHROMOSOMES

Pendić B., Lovrić Lj., Plećaš V., Dragović M.

City Hospital — Beograd

The cytogenetic analyses of the cells from peripheral blood were made in the patients after x-ray diagnostic procedure-gastrointestinal series.

These preliminary reports do suggest that chromosomal anomalies can be induced by x-ray, even at the relatively low dosage levels used for diagnostic procedures.

The preirradiation cultures were considered to be adequate controls. The frequency of chromosmal aberrations following exposure to diagnostic irradiation chowed significant change from the preirradiation levels, particulary the increase of aneuploid cells.

A — 100

EFEKAT MALIH DOZA JONIZUJUĆIH ZRAČENJA NA TRANSFORMACIJU LIFMOCITA U KULTURI STIMULISANIM SA FITOHEMAGLUTININOM

Lovrić Lj., Pendić B., Plećaš V.

Gradska bolnica — Beograd

U radu se iznose rezultati dobijeni prilikom kultivisanja limfocita osoba ozračenih malim dozama zračenja.

Autori diskutuju dobijene rezultate u odnosu na kontrolnu grupu.

EFFECT OF SMALL DOSES OF ONIZING RADIATIONS ON LYMHOCYTE TRANSFORMATION IN THE CULTURES STIMULATED WITH PHYTOHEMAGGLUTININ

Lovrić Lj., Pendić B., Plećaš V.

Hospital City — Beograd

Results from studies with lymphocyte cultivation from persons irradiated with small doses of ionizing radiations

are discussed. The results presented are compared with the control group.

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HEMATOLOŠKE KONTROLE RADNIKA PROFESIONALNO IZLOŽENIH DEJSTVU JONIZUJUĆIH ZRAČENJA

Veljković D.

Institut za nuklearne nauke »Boris Kidrič«
Medicinska zaštita, Beograd

U radu su dati rezultati hematoloških pregleda jedne grupe radnika koji su u toku rada bili izloženi spoljnom gama zračenju različitog intenziteta i u toku različitog perioda, a kod kojih nije dolazilo do prekoračenja maksimalno dozvoljenih doza.

Ispitivanja su obuhvatila standardne preglede krvne slike i analizu citomorfoloških promena. Analiza je vršena na običnim razmazima periferne krvi bojenim po Pappenheimu. Klasična hematološka ispitivanja pokazala su da se vrednosti u krvnoj slici kreću u granicama fizioloških varijacija. Analiza citomorfoloških promena pokazala je veći procenat izmenjenih ćelija periferne krvi kod radnika sa dužim radnim stažom, odnosno sa većim akumuliranim dozama u odnosu na osobe sa manjim ukupnim dozama. Neke od nađenih morfoloških promena smatraju se osetljivim indikatorima za predpatološka stanja, koja se odigravaju u organizmu čoveka pod dejstvom malih doza zračenja.

Mada su individualne razlike u pogledu radioosetljivosti veoma izražene, postoji mogućnost da se ove promene koriste u biodozimetriji.

HEMATOLOGIC CONTROL OF WORKERS OCCUPATIONALLY EXPOSED TO IONIZING RADIATION

Veljković D.

Institute for Nuclear Sciences »Boris Kidrič« — Vinča

The paper presents results for hematologic examinations of a group of workers occupationally exposed to ex-

ternal gamma radiation of different intensities and for various periods of time. The results have not shown any excess of the maximum permissible doses.

The examinations included standard examination of the blood picture and analysis of cytomorphologic changes. The analysis was made on ordinary smears of the peripheral blood stained by Pappenheims method. Classical hematologic examinations have shown that the values of the blood picture varies within physiologic variations. Analysis of the cytomorphologic changes has shown a higher percentage of changed cells of the peripheral blood in workers who have been working for a long time, i.e. who have larger accumulated doses compared with those with smaller accumulation. Some of the morphologic changes are considered sensitive indicators for prepathologic states, which occur in the organism of man by the effect of small radiation doses.

Although the individual differences regarding the radiosensitivity are very remarkable, it is possible for these changes to be used in biodosimetry.

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HROMOZOMSKE ABERACIJE U LEUKOCITIMA PERIFERNE KRVI U OSOBA PROFESIONALNO IZLOŽENIH JONIZUJUĆIM ZRAČENJIMA

Pendić B.

Gradska bolnica — Beograd

U članku se iznose rezultati citogenetskih ispitivanja u osoba izloženih dozvoljenim dozama zračenja.

Broj ćelija sa hromozomskim aberacijama je znatno veći nego u kontrolnoj grupi. Promene se odnose kako na brojne tako i morfološke.

Autor diskutuje odnos između doze zračenja i zapaženih promena kao i njihov klinički značaj.

CHROMOSOME ABERRATIONS OF LEUCOCYTES FROM PERIPHERAL BLOOD IN THE PERSONS OCCUPATIONALLY EXPOSED TO IONIZING RADIATIONS

Pendić B.

City Hospital — Beograd

In the article the authors discuss the results of cytogenetics investigations in the persons exposed to the permissible doses of radiations.

The number of cells with chromosome aberrations is considerable higher than in the control group. The noticed changes refer to the number as well as to the morphology of the chromosomes. The author discuss the relation between these changes and dose levels of the radiations and the clinical significance as well.

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PROFESIONALNA OŠTEĆENJA MEDICINSKOG OSOBLJA IZLOŽENOG IONIZIRAJUĆEM ZRAČENJU U GRADU ZAGREBU

Čanić Z., Fleischhacker M.

Zavod za zaštitu zdravlja grada Zagreba — Zagreb

Autori prikazuju rezultate periodskih medicinskih pregleda liječnika i ostalog medicinskog osoblja izloženog ionizirajučem zračenju kroz period od 1946.. g. do 1968. godine.

Iznose se podaci prema zvanju, struci, spolu i radnom mjestu pregledanih osoba, a zatim utvrđena profesionalna oštećenja s obzirom na vrst rada i oštećene organe.

Utvrđen je procentualno veći broj oštećenja kod liječnika nego kod ostalog medicinskog osoblja. Pretežni broj oštećenja su bila profesionalna oštećenja kože, a relativno mali postotak predstavljaju oštećenja hematopoetskih organa.

Kod grupe liječnika se radilo uglavnom o oštećenjima kože, dok je kod pomoćnog medicinskog osoblja procentualno veći broj oštećenja hematopoetskih organa, što je, kako autori smatraju, ovisilo o ekspoziciji i načinu rada te ličnoj i tehničkoj zaštiti.

Kožna oštećenja su bila pretežno na rukama a oštećenja hematopoetskih organa su se pretežno očitovala sa leukopenijom, neutropenijom i morfološkim promjenama na leukocitima.

OCCUPATIONAL LESIONS OF MEDICAL PERSONNEL EXPOSED TO IONIZING RADIATION IN THE CITY OF ZAGREB

Čanić Z., Fleischhacker M.

Institute for Health Protection — Zagreb

The authors discuss the results of periodical examinations of physicians and other medical personnel having been occupationally exposed to ionizing radiation in the period from 1946 to 1968.

Data are analysed according to the working place, training, and sex of the persons examined. The authors discuss several questions connected with occupational lesions as ware evidenced in different kinds of work and in different organs.

A higher percentage of lesions was evidenced in the group of physicians than in the group of other medical personnel.

A predominant number of lesions related to occupational skin lesions and a relatively small percentage to the lesions of the hematopoietic organs.

In the group of physicians skin lesions prevailed, while in the group of auxiliary medical personnel a higher percentage of lesions related to the hematopoietic organs. The authors believe that this depended on exposure, attitudes during work, and personal and technical protection.

Skin lesions were predominantly on hands, while lesions of the hematopoietic organs manifested themselves as leucopenia, neutropenia, and porphological changes in leucocytes.

GONADNE DOZE KOJE DOBIJA STANOVNIŠTVO SLOVENIJE USLED UPOTREBE X-ZRAKA U DIJAGNOSTICI

Mihailović M.

Institut za fiziko Medicinske fakultete — Ljubljana

Opisano je određivanje gonadnih doza pri upotrebi x-zraka u dijagnostici. Sakupljene su informacije o broju dijagnostičkih pregleda u 1960. godini i 1963. godini. Iz statističkih podataka o broju pojedinih tipova pregleda te njihovoj raspodeli po polu i starosti, i iz izmerene gonadne doze kod muških i preračunate gonadne doze za ženske određena je genetska doza. Srednja gonadna doza iznosi 11,3 mR na godinu na stanovnika, i odgovarajuća genetska doza 9,1 mR na godinu na stanovnika.

GONADE DOSES RECEIVED BY POPULATION OF SLOVENIA AFTER DIAGNOSTIC USE OF X-RAYS

Mihailović M.

Physic Institute of Medical Faculty — Ljubljana

The determination of gonad doses from diagnostic use of x-ray has been described. The informations on diagnostic x-ray examinations covering the years 1960 and 1963 were collected. From the obtained statistical data on the number of different types of examinations, their distribution according to age and sex, and from measured values of gonad doses for men and determined values of gonad doses for women, the genetic dose has been determined. An average gonad dose of 11,3 mR per year per inhabitant, and a genetic dose of 9,1 mR per year per inhabitant has been found.

OŠTEĆENJE GONADA KOD TERAPIJE BOLESNIKA NA TELEKOBALT UREĐAJU

Konstantinović M., Voskresenski I., Bistrović M.

Zavod za Onkologiju i radioterapiju pri kliničkom bolničkom centru »Rebro«, Zagreb

Zračenjem pojedinih dijelova tijela kod bolesnika koji boluju od malignog tumora dolazi u većoj ili manjoj mjeri do sekundarnog zračenja i na gonade. Doza zračenja koju dobijaju spolni organi, ovisi o udaljenosti i veličini polja zračenja, kao i o ostalim parametrima tehnike zračenja. Gonadna doza je kod telecobalt terapije znatno manja nego kod zračenja sa Röntgen-terapijom. Problem je aktuelan kod bolesnika, koji eventualno nakon izliječenja žele imati potomstvo, i kod njih je gonadna doza ozračenja važna. U većini slučajeva doze nisu znatno veće od doze rizika kod profesionalno izloženog osoblja zračenju.

THE DAMAGE OF THE GENITALS AT THE TELECOBALT RADIATION ON THE PATIENTS WITH MALIGN TUMORS

Konstantinović M., Voskresenski I., Bistrović M.

Institute for Oncology and Radiotherapy »Rebro«, Zagreb

By the radiation of particular body parts of the patients suffering from malign tumors, the genitals are more or less affected by secondary radiation. The dose of this radiation depends on the distance and the extension of the radiated part, as well as on the other elements of the radiation technique. The radiation dose of genitals by the telecobalt therapy is remarquably smaller than that by the X-rays therapy. The actual problem is with the patients, who after getting well again wish to have their posterity;

therefore the radiation dose of their genitals is very important. In most cases this dose of radiation is not greater than the risk dose to which is exposed the professional staff.

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REZULTATI SISTEMATSKIH PREGLEDA ORGANA VIDA U OSOBA HRONIČNO IZLOŽENIH DEJSTVU X ZRAČENJA

Savić S., Jeremić M.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

Ukupno je pregledano 183 osobe hronično izložene dejstvu X zračenja.

Od ovoga broja bilo je 111 rentgen tehničara, 25 ftiziologa, 23 rentgenologa, 13 stomatologa i zubarskih tehničara i 11 lekara koji povremeno rade sa rentgenom.

Prikazano je stanje organa vida u pregledanih osoba. Kod osoba kod kojih je registrovana katarakta postavlja se pitanje da li hronično dejstvo malih doza X zračenja može da deluje kao kofaktor u nastanku katarakte.

RESULTS OF SYSTEMATIC EXAMINATIONS OF THE EYESIGHT OF PERSONS CHRONICALLY EXPOSED TO X-RADIATION

Savić S., Jeremić M.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović« — Beograd

183 persons chronically exposed to X-ray arradiation has been examined.

Of this number there were 111 Roentgen technicians, 25 phthisiologists, 23 roentgenologists, 13 stomatologists

an dental technicians, and 11 physicians periodically working with X-ray apparatuses.

The condition of the eyesight of the persons examined has been presented. With people where cataract has been ascertained the question is being put whether a chronical exposition to small doses of X radiation may act as cofactor in the development of cataract.

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PROFESIONALNA OŠTEĆENJA KOŽE KOD LICA IZLOŽENIH DEJSTVU JONIZUJUĆIH ZRAČENJA

Jeremić M., Kilibarda M.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović«

Oštećenja kože usled jonizujućeg zračenja, posle kontaktnih dermatita i ekcema spadaju među najčešća profesionalna oboljenja kože. Prema zapažanjima pojedinih autora ova oboljenja čine 10% svih profesionalnih dermatoza.

Dispanzer za radijaciona oštećenja Instituta za medicinu rada i radiološku zaštitu »Dr Dragomir Karajović« duži niz godina vrši sistematsku kontrolu lica profesionalno izloženih dejstvu jonizujućih zračenja. U okviru sistematske kontrole izvršen je pregled kože kod 1664 osobe koje su u toku svoje profesije različito dugo izložene dejstvu ovih zračenja. Takođe su posmatrani i redovno kontrolisani svi slučajevi gde je postojao radiodermit profesionalnog porekla i praćena njegova zavisnost od uslova rada.

Pri ovim ispitivanjima nađeno je 52 slučaja hroničnog oštećenja kože različitog stepena. U radu se iznosi učestanost profesionalnih radiodermita kod ispitivanih radnika prema profesionalnoj strukturi i u odnosu na dužinu radnog staža eksponovanih osoba kao i karakteristična zapažanja iz ovog ispitivanja.

OCCUPATIONAL IMPAIRMENTS OF THE SKIN IN PERSONS EXPOSED TO IONIZING RADIATIONS

Jeremić, M., Kilibarda, M.

Institute of Occupational and Radiolagical Health Beograd

The skin injuries due to ionizing radiation, after contact dermatites and eczemas belong to the most frequent occupational diseases of the skin. Accordnig to the observations of some authors these diseases represent 10 per cent. of all occupational dermatoses.

The Dispensary of Radiation Impairments of the Institute of Occupational and Radiological Health »Dr Dragomir Karajović« for a number of years performs the regular control of the persons occupationally exposed to the effect of ionizing radiations.

In the frame of this control in all examined, the skin examination was made in 1664 persons who during they work are exposed to radiations of various duration. All casese where radiodermatitis of occupational origin existed were observed and regularly controlled and also its dependence upon the working conditions has been followed.

At these investigations 52 cases of chronic skin injuries of various degree were found. In this paper a frequency of occupational radiodermatites in the examined workers according to occupational structure and in relation to employment time of exposed persons just as characteristic observations from these investigation are given.

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OŠTEĆENJA PLUĆNOG PARENHIMA IZA PRIMJENE POSTOPERATIVNE TC TERAPIJE KOD KARCINOMA DOJKE

Kubović M., Jakaša Đ., Bistrović M.

Zavod za kliničku onkologiju i radioterapiju Medicinskog sveučilišta u Zagrebu

Bolnica za bolesti pluća — Jordanovac

Autori su pratili promjene na plućima koje su se razvile kod bolesnica koje su iza radikalne mamektomije pri-

male postoperativnu TC terapiju. TC terapija primjenjivala se kod tih bolesnica preko 3 kožna polja: aksilarnog, supraklavikularnog i sternalnog.

Iznose se fizikalni podaci o dozi koja se oslobodi u plućnom parenhimu uz primjenu TCT preko opisana tri polja.

Ujedno se ukazuje na mogućnosti koje mogu povisiti ovu dozu u plućnom parenhimu.

Prikazuju se rtg snimke bolesnica na kojima se vide različite promjene plućnog parenhima koje su se razvile iza opisane TCT.

Iza toga autori iznose terapiju koju su primjenili kod tih bolesnica.

U zaključku iznose se prijedlozi s pomoću kojih bi se ova oštećenja svela na minimum.

INJURIES OF THE PULMONARY PARENCHYMA AFTER THE APPLICATION OF THE POSTOPERATIVE TC THERAPY IN THE CA MAMMAE

Kubović M., Jakša Đ., Bistrović M.

Institute for Oncology and Radiotherapy, »Rebro«
Zagreb

The authors have followed the changes on the lungs which developped in women patients treated, after a radical mammaectomy, by a postoperative TC therapy.
The TC therapy was applicated in these women through 3 skih fields: the axilary, the supraclaviculary and the stenal one.

The authors allege the physical data about the dosis delivered in the pulmonary parenchyma during the TC therapy thorough the 3 mentioned skin fields. Simultaneously the authors show the possibility to raise this dosis in the pulmonary parenchyma. They present X-ray pictures of the women patients on which different changes of the pulmonary parenchyma during the TC therapy can be seen. The authors describe afterwards the therapy applicated in the patients and present their suggestions how to reduce as much as possible the injuries of the pulmonary parenchyma.

ISPITIVANJE SERUM PROTEINA KOD OSOBA PROFESIONALNO IZLOŽENIH MALIM DOZAMA JONIZUJUĆEG ZRAČENJA

Radošević S.
Institut za nuklearne nauke »Boris Kidrič« — Vinča

Izučavani su serum proteini kod osoba koje su po prirodi posla izložene dejstvu malih doza jonizujućeg zračenja. Akumulacione doze iznosile su od 2000 — 19000 mrema, prema podacima dobijenim sa penkala i film dozimetara. Radni staž je bio od 1 — 11 godina.

Između vrednosti ukupnih proteina osnovne i kontrolne grupe nisu zapažene razlike. Elektronska analiza je pokazala neznatne razlike u odnosu proteinskih frakcija, osnovne i kontrolne grupe. Kod ispitivane grupe dobijene su veće vrednosti za albuminsku i gama-globulinsku frakciju. Razlike nisu bile statistički značajne.

Mada navedena biohemijska ispitivanja nisu pokazala odstupanja od normalnih vrednosti, ne isključuje se mogućnost da posle dugotrajnije ekspozicije malim dozama zračenja nastanu promene kako u koncentraciji ukupnih proteina, tako i u odnosu proteinskih frakcija.

INVESTIGATION OF SERUM PROTEINS IN INDIVIDUALS OCCUPATIONALLY EXPOSED TO SMALL DOSES OF IONISING RADIATIONS

Radošević S.

Institut of Nuclear Sciences »Boris Kidrič« — Vinča

Serum proteins of individuals occupationally exposed to small does of ionising radiation were investigated.. The accumulated doses were from 2000 to 19000 mrems, according to data from pen and film dosimeters. The time period of exposure was from 1 to 11 years.

No differences were observed between values of total proteins between control and experimental groups. Greater values for albumin and gama-globulin fractions were

observed. The differences were not statistically significant. Individual values were within physiological limits.

Although the above mentioned results did not snown variations from normal values, the possibility of changes in total proteins and rations of individual protein fractions after long term exposure to small doses of radiation is not excluded.

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POKUSI NA ŽIVOTINJAMA SA ZRAČENJEM ČITAVE KOŽE NEFILTRIRANIM MEKANIM RENDGENSKIM ZRACIMA

Betetto M.

Dermatološka klinika Medicinske fakultete Ljubljana

Zbog terapeutske metode rendgenskog zračenja kože iz velike udaljenosti sa nefiltriranim mekanim zracima. vršili smo opite kod više grupa zamoraca, kontrolirajući njihov hemogram i histološku sliku germinativnog epitela testisa. Zamorce smo zračili na isti način sa nefiltriranim mekanim zracima, ili sa polutvrdim konvencionalnim zracima. Ove dve grupe smo upoređivali međusobno, a isto tako i sa kontrolnim nezračenim grupama.

Oštećenja testisa smo primetili već za vreme dvanaeste nedelje zračenja. Efekat mekanih zraka na hemogram mogli smo ustanoviti tek retrogradno, upoređujući kroz četrdeset nedelja prosečnu liniju brojeva krvnih ćelija zračenih životinja sa linijom nezračene kontrole. Za sve to vreme pojedinačni hemogrami svih tih životinja bili su normalni.

Iz toga zaključujemo, da se prilikom rendgenskog zračenja kože iz velike udaljenosti, a kod uobičajenog terapeutskog doziranja, ne mogu očekivati tako teška oštećenja hematopoetskog sistema, koja bi se odrazila na hemogramu, unatoč malenim dozama kojima je hematopoetski sistem bio izložen. Sa druge strane vidi se iz rezultata od kolike je važnosti adekvatna zaštita testisa kao i ekzaktno postavljanje indikacije kod ove vrste terapije.

Reaktivnost krvotvornog sistema i germinativnog epitela prema rendgenskim zracima kod zamoraca vrlo je slična reaktivnosti kod čoveka, pa je zato iz rezultata naših pokusa moguće izvesti korisne zaključke za terapeutsku praksu.

CONCERING SOME ANIMAL TESTS WITH LONG DISTANCE X-RAY IRRADIATION

Betetto M.

Clinic of Dermatology, Medical Faculty — Ljubljana

The blood pictures and animal epithelia of several groups of guinea pigs, similarly exposed to unfiltered soft ray irradiation, were examined and results were compared with controll groups irradiated with medium hard rays, as well as unexposed controlls.

Whereas the effects on the testes became clearly visible in the 12 th week, the effects of soft unfiltered radiation on the blood picture could only be established retrograde by a comparative evaluation of blood cell curves projected over 40 weeks in exposed and unexposed animals; but they could not be established by examination of single, numerically always phisiological haemogrammes.

It is possible to act upon the results obtained in the rapeutic practice, subject to protective measures as described being taken.

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DELATNOST MEDICINSKE ZAŠTITE INSTITUTA »BORIS KIDRIČ« U KONTROLI PROFESIONALNO EKSPONIRANIH LICA IZVORIMA JONIZUJUĆIH ZRAČENJA U INDUSTRIJI I DRUGIM ORGANIZACIJAMA

Đukić Z., Stojanović D., Veljković D., Aleksić B., Trajković M. i Ubović Ž.

Institut za nuklearne nauke »Boris Kidrič« Vinča — Beograd

U radu su dati rezultati pregleda radnika koji rade u industriji, medicinskim i drugim radnim organizacijama, a profesionalno eksponirani junizujućim zračenjima.

Dobijeni rezultati pokazuju da i pored većine vrednosti nađenih kod pregledanih radnika, a koje se kreću u granicama normale, ima izvesnih kliničko-laboratorijskih promena pod dejstvom zračenja na osnovu kojih je moguće izvršiti ocenu zdravstvenog stanja lica koja rade sa otvorenim i zatvorenim izvorima jonizujućih zračenja.

Na osnovu utvrđenih kriterijuma za ocenu hemotoloških vrednosti, radiotoksikoloških analiza u odnosu na MDK za celo telo u profesionalnim uslovima rada kao i analiza rezultata dobijenih drugim pregledima, data je ocena indikacija i kontraindikacija za rad sa izvorima jonizujućih zračenja.

THE WORKING OF THE HEALTH PROTECTION DEPARTMENT OF THE INSTITUTE »BORIS KIDRIČ« IN THE CONTROL OF THE PROFESSIONALLY EXPOSED PERSONS TO THE SOURCES OF THE IONISING IRRADIATIONS IN THE INDUSTRY AND OTHER ORGANIZATIONS

by

Đukić Z., Stojanović D., Veljković D., Aleksić B., Trajković M. and Ubović Ž.

Nuclear Sciences Institut »Boris Kidrič« - Vinča - Beograd

In this report are given the results of the inspection of the workers, working in the industry, medical and other working organisations, but who are professionally exposed to the ionizing irradiation.

The results obtained show that aside from the great part of values, which are in the normal limits, there are some clinical and laboratory changes, under the action of the irradiation, on which bases it is possible to make the evaluation of the state of health of the persons working at the different sources of irradiation.

On the bases of fixed criterium for the estimation of the hematological values, radiotoxicological analyses in relation to MDK for the whole body in the proffessional conditions of the work and analyses of the other results, the estimation of the indication and contraindication for the work which the sources ionizing irradiation is given

VREDNOST FILM-DOZIMETRIJE I KONTROLA PRIMLJENE DOZE JONIZANTNOG ZRAČENJA

Malinski B., Stojanov S., Kalendarov Z.

Republički zavod za zdravstvena zaštita Skopje

U uvodnom delu referata autori govore o nekim zakonskim odredbama osnovnog zakona za zaštitu od jonizantnog zračenja. Zatim daju kritički osvrt o dozvoljenoj dozi ozračivanja lica, date u pravilniku za dozvoljene doze jonizantnog zračenja i mestu film-dozimetrije u pomenutom pravilniku.

Naučne postavke film-dozimetrije kao metode za detekciju jonizantnog zračenja i njezin domen u sferi apsolutnih egzaktnih merenja.

Dosadašnja iskustva sa film-dozimetrijom u nekim zdravstvenim ustanovama, njezini rezultati, način upotrebe i nedostaci.

Komparativni nalazi film-dozimetra nošen zakonskim odredbama sa film-dozimetrom na »plavom mestu« (prikaz diapozitiva).

Komparativni nalazi film-dozimetrije sa džepnim dozimetrima elektronske industrije iz Niša (prikaz diapozitiva).

Komparativni rezultati film-dozimetrije i Viktorin jonizacione komore kod nekih standardnih radioloških snimanja i diaskopije digestivnog trakta (prikaz diapozitiva).

Labirint različitih doza koje nastaju u prostoriji rentgenološke dijagnostike. Film-dozimetar i kvantum zračenja žive materije izvan njegovog polja registracije.

U zaključku svog referata autori opisuju da li film dozimetar poseduje svojstvo fine osetljivosti kod detekcije Rö zračenja i u kom stepenu može ukazivati na inhomogenu zračnu opasnost koja vlada u prostoriji rentgenološke dijagnostike za vreme diaskopije ili rtg. snimanja. Čime registrovati opasne zone u prostoriji Rö aparature i uočavati slaba mesta radiološke zaštite?

Sadašnja vrednost film-dozimetrije i naučna opravdanost njezine upotrebe.

THE VALUE OF THE FILM-DOSIMETRY AND THE CONTROL OF RECEIVED DOSE OF IONIZING RADIATION

Malinski B., Stojanov S., Kalendarov Z.

City Hospital Kumanovo

Institut of Pablic Health Skopje

In the introduction of the paper the autors discuss the fundamental law and code of the protection of X-ray. They discuss maximal dose allowed with the code as well as film-dosemeasuring.

The film-dosemeasuring scientific attitude as a metod of X-ray radiation detection and exactly measurement.

The experience with film-dosemeasurement at the some medical institutions, the results, way of use and lacks.

Comparative rates of the film-dosemeasurer having it at the »right place«, ordered by the code. (diapositives).

Comparative rates between film-dosemeasurer and pocked-dosemeasurers of Nish Electronic Industry. (diapositives).

Comperative results of the film- dosemeasuring and Victoreen radiation-chamber by some standard X-ray taking and digestive system diascopy. (diapositives).

A labyrinth of different doses existing in X-ray diagnostic space. A film-dosimeasurer and radiation quantity of the living matter out of his registration field.

At the conclusion the autors are hasitating about the film-dosemeasurer property of high X-ray detection fidelity and possibility of unhomogen air danger detection, being in the radiology diagnostical space during diascopy or X-ray taking.

How to registrate the dangerous zone in the X-ray room and to detect the unprotected places of X-radiation? The value of the film-dosemeasuring method and his scientific justification of the use, up, to the present time.

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ANALIZA FILM-DOZIMETRISKE KONTROLE U MEDICINSKIM USTANOVAMA U SRS U 1968 GODINI

Ignjatović S.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« Beograd

Daje se pregled profila lica izloženog zračenju. Posebno se upoređuju prosečne doze lica zaposlenih na Radiološkom institutu i Institutu za TBC. Diskutuje se predlog za obustavljanje filmdozimetrijske kontrole pri primeni X zračenja.

ANALYSIS OF A FILM-DOSIMETRIC CONTROL IN MEDICAL INSTITUTIONS IN SR SERBIA IN 1968.

Ignjatović, S.

Institute of Occupational and Radiological Health
»Dr Dragomir Karajović«, Beograd

A review of the personnel exposed to radition is given. Separately the average doses of the persons employde at Radiological institute and the Institute of tuberculosis are compared. It is discussed the proposal for stoppage of film-dosimetric control at medical application of X-radiation.

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O ODREĐIVANJU TVRDOĆE ZRAČENJA FILMODOZIMETROM

Sterle M.
Zavod za varnost pri delu-Ljubljana

Film je eksponiran preko metalnog klina debljine od 0 do 2 mm. Kontinuiranom denzitometrijom određen film daje kod različitih energija zračenja karakterističan tok krive zacrnjenja.

Familija kriva iste doze ekspozije a različitih energija daje mogućnost determinacije parametara koji definišu energiju zračenja.

ON THE DEFINITION OF THE SOURCE OF SECONDARY RADIATION

Sterle M.
Institute of Work Protection-Ljubljana

The film is being exposed through a metal peg, from 0 to 2 mm thick. The continuous densitometry processed film gives at varying energies of radiation a characteristic flow of the shadowing curve.

A family of curves of the same dose of exposure but of varying energies makes possible the determination of the parameters defining the energy of radition.

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ODREĐIVANJE INTEGRALNE APSORBIRANE DOZE POMOĆU DVOSTRUKE PLOŠNE IONIZACIONE KOMORE

Kempni K., Petrovčić F., Planinić J., Jakobović Z.

Zavod za fiziku i matematiku farmaceutsko-biokemijskog fakulteta opšte bolnice »Dr O. Novosel« — Zagreb

U svrhu pronalaženja jednostavne i praktične metode određivanja integralne apsorbirane doze pri medicinskim dijagnostičkim pregledima ispitivana je apsorpcija energije rendgenskog zračenja u vosku, pleksistaklu i vodi uz različite kvalitet zračenja. Mjerena je energija cjelokupnog snopa rendgenskog zračenja pred apsorberom i iza njega pomoću dveju dvostrukih plošnih ionizacionih komora (Philips Dagnostic X-ray Monitor). Te ionizacione komore pokazuju energiju prolaznog snopa zračenja u dobroj mjeri neovisno o kvalitetu rendgenskog zračenja. Nađeno je, da za snop rendgenskog zračenja kao cjeline vrijedi jednostavan zakon apsorpcije.

Na temelju tog zakona apsorpcije, te mjerenjem debljine apsorbera i energije zračenja što ulazi u apsorber. može se onda na jednostavan način odrediti integralna apsorbirana doza.

DETERMINATION OF A THE INTEGRAL ABSORBED DOSE BY MEANS OF A FLAT DUAL IONISATION CHAMBER

Kempni K., Petrović F., Planinić J., Jakobović Z.

Department of Physics and Mathematics, Faculty of Pharmacy and Biochemistry, University of Zagreb

In order to find a simple and practical method for determining the integral absorbed dose during medical X-ray examinations, the absorption of radiation energy in wax plexiglass and water for various radiation qualities was investigated. The energy of the total X-ray radiation beam in front of the apsorber and behind it was measured by means to two flat dual ionsation chambers (Philips Diagnostic X-ray Monitor). The recording procedure of radiation energy by these chambers is fairly independent of the quality of X-ray radiation. A simple law of absorption for the entire X-ray beam was found.

On the basis of this absorption law and by measuring the thickness of the absorber and the radiation energy entering the absorber the integral absorbed dose can be determined in a simple way.

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NAŠA ISKUSTVA SA DVOSTRUKIM PLOŠNIM IONIZACIONIM KOMORAMA

Jakobović Z., Kempni K., Petrovčić F.

Zavod za fiziku i matematiku Farmaceutsko-biokemijskog fakulteta, Zavod za rendgenologiju medicinskog fakulteta

Opće bolnice »Dr O. Novosel« Zagreb

Za određivanje integralne doze postavljene su u Zavodu za rendgenologiju Opće bolnice »Dr O. Novosel« u

Zagrebu dvije dvostruke plošne ionizacione komore (Philips Diagnostic X-ray Monitor), i to jedna na uređaju za dijaskopiju, druga na jednom od uređaja za snimanje. Obe komore su ispoređivane međusobno i sa jednom Victoreen-komorom. Ispitivana je također zavisnost pokazivanih vrijednosti o trajanju, intenzitetu i visokom naponu.

Originalno su obe komore bile zajednički spojene na isti mjerni instrument, tako da se nisu mogle istodobno primijeniti. Zato je izrađen posebni preklopnik, kojim se mogu komore svaka za sebe spojiti s mjernim instrumentom.

Otkriveni su neki nedostaci u izolaciji samih komora i djelomično uklonjeni. Isto je tako lokaliziran prekid u jednom od kablova i uz prilične poteškoće uklonjen. Nakon uklonjenih nedostataka i uz stanovite mjere opreza mogla se ispravno mjeriti energija prolaznog snopa zračenja.

Stečena iskustva mogu poslužiti za stanovita poboljšanja u konstrukciji takvih komora kao i pri njihovom postavljanju.

Opisane dvostruke plošne ionizacione komore upotrebljavane su pri mjerenjima o kojima se referira u radu K. Kempni i dr.: Određivanje integralne apsorbirane doze pomoću dvostruke plošne ionizacione komore.

OUR EXPERIENCES WITH FLAT DUAL IONIZATION CHAMBERS

Jakobović Z., Kempni K., Petrovčić F.

Department of Phisics and Mathematics, Faculty of Pharmacy and Biochemistry, Universty of Zagreb; Department of Roentgenology, General hospital »Dr O. Novosel«, Zagreb

For the determination of integral doses in the X-ray department of the hospital »Dr O. Novosel« in Zagreb two flat dual ionization chambers (Philips Diagnostic X-ray Monitor) were mounted on two X-ray installations, one for fluoroscopy, the other for radiography. The two ionisation chambers were compared with each other and with a Victoreen-chamber. Also the dependence of their indications on time, intensity and H. T. were investigated.

Originally, the two ionization chambers were together connected to the same measuring device, so they could

not be used simultaneously. Therefore, a special switch was constructed, to connect separately each chamber to the measuring device.

Some shortcomings in the insulation of the chambers themselves were detected and partly removed. Also a defect in one of the cables was located and removed with some difficulty.

After the removal of the mentioned shortcomings and with some precaution, the energy of the passing radiation beam could be measured correctly.

The experiences acquired may help to improve the construction and installation of such flat ionization chambers.

The described flat dual ionisation chambers were used in the measurements decribed in the paper by K. Kempni et al. »Determination of the Integral Absorbed Dose by means of a Flat Dual Ionization chamber«.

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APSOLUTNO MERENJE EKSPOZICIONE DOZE GAMA-ZRAČENJA VAZDUŠNOEKVIVALENTNOM KOMOROM

Novković D., Bek-Uzarov Đ.

Institut za nuklearne nauke »Boris Kidrič« u Vinči, Beograd

Prikazana je metoda merenja ekspozicione doze pomoću komore »naprstak« čiji su zidovi napravljeni od vazdušnoekvivalentnog materijala. Dat je pregled potrebnih korekcionih faktora, koje je neophodno odrediti, bilo računskim putem, bilo merenjem, da bi merenje bilo apsolutno.

AIR-EQUIVALENT IONIZATION CHAMBER MEASUREMENTS OF GAMMA-RADIATION EXPOSURE DOSES

Novković D., Bek-Uzarov Đ.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča Beograd

A method is described for the measurement of absolute exposure doses of gamma-radiation applying a cavity-

ionization chamber whose walls are made of aireqivalent material. In odred to provide absolute measurements, a review of the necessary correction factors, which should be determined either by calculation or by measurement, is given.

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UNIVERZALNI MONITOR ZRAČENJA

Muždeka S., Damljanović D., Ristić Đ.

Institut za nuklearne nauke »Boris Kidrič« Vinča

Dat je opis univerzalnog monitora zračenja sa sondama koje sadrže halogene GM brojače i proporcionalne brojače.

Pomoću dijagrama i kalibracionih krivih dat je opis sondi za merenje alfa, beta/gama i mekog X zračenja.

Korišćenjem strujnih GM brojača mogu se meriti jačine ekspozicionih doza do nekoliko stotina R/h.

MULTIROBE RADIATION MONITOR

Muždeka S., Damljanović D., Ristić Đ.

Institute of Nuclear Sciences »Boris Kidrič« — Vinča

A radiation monitor with probes contaning halogenous GM and proportional counters is described.

Probes for the measurement of alpha, beta/gamma and soft X radiations are described using diagrams and calibration curves.

Current GM tubes can be used for the measurement of exposure rates up to several hundreds of R/h.

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MINIJATURNI LOVAC ZRAČENJA

Damljanović D.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Prikazan je minijaturni instrument koji omogućuje detekciju i indikaciju osnovnih vrsta zračenja (beta, gama) ne pretendujući na njihovo kvantitativno određivanje. Obzirom na svoje osnovne karakteristike može da se masovno upotrebi u organizaciji zaštite ljudstva u akcidentalnim uslovima. Osnovne karakterstike su mu: niska cena, mali format, minimalna potrošnja — u normalnim uslovima radi više hiljada časova bez isključivanja.

MINIATURE RADIATION DETECTOR

Damljanović D.

Institute of Nuclear Sciences »Boris Kidrič« — Vinča

The paper describes a miniature instrument for the detection and indication of the basic types of radiation (beta, gamma) without the determination of their quantities. Owing to its basic characteristics the detector can be used for the personnel protection in accidents. Its main characteristics are: low price, pocket size, minimum consumption — under normal conditions it operates continously for several thousands of hours.

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SPEKTAR X ZRAČENJA 6 VENTILNOG SIEMENS RÖ APARATA PRI ANODNOM NAPONU OD 65, 70, 80 kV

Ignjatović S.

Institut za medicinu rada i radiološku zaštitu »Dr Dragomir Karajović« Beograd

Prikazuje se spektar X zračenja dobijen pri analizi na Ge-Li kristalu. Upoređuje se promena spektra pre i posle

prolaska snopa zračenja kroz pojedine delove čovečijeg tela. Diskutuje se promena intenziteta pojedinih linija spektra i gubitak jednog dela spektra nakon prolaska snopa kroz čovečije telo.

X-RADIATION SPECTRUM OF 6-VALVE SIEMENS ROENTGEN APPARATUS AT ANODIC VOLTAGE OF 65, 70 AND 80 kV

Ignjatović S.

Institute of Occupational and Radiological Health »Dr Dragomir Karajović«, Beograd

X-radiation spectrum obtained by analysis at Ge-Li crystal is represented. The change of spectrum before and after passing the beams of radiation through the individual parts of human body is compared. The change of intensity of single lines of spectrum and loss of a part of spectrum after passing the beams through the human body is discussed.

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SCINTILACIONI FOTODOZIMETAR ZA REKTALNU APLIKACIJU KOD VAGINALNE I INTRAUTERINE RADIJUMSKE TERAPIJE

Kneževič Z., Pujić Z.

Prirodno-matematički fakultet — Sarajevo

Kod vaginalne intrauterine radijumske terapije neizvjesna je eksponiranost pojedinih regija rektuma i vesicae urinaria, zbog anatomskih specifičnosti. Za utvrđivanje polja doze duž rektuma u ovim prilikama, konstruisali smo novu vrstu dozimetra kod koga je scintilirajuće tijelo dozimetra cilindrično i sačinjeno od niza NaJ (TI) kristala. Oni su podesno upakovani, pa se obavijaju fotomaterijalom i uvlače u metalni tubus zbog zaštite od svjetla.

Baždarenje je izvedeno na standardizovanom Ra-226 izvoru, a zacrnjenja su mjerena na denzitometru EEL, model A. Procjena rektalnih doza može biti ostvarena već 12 minuta poslije početka terapije. Pored doze, ovim dozimetrom može se locirati i najugroženija regija rektuma, sa greškom od ± 0,5 cm.

SCINTILATION PHOTODOSIMETER FOR RECTAL APPLICATION USED FOR VAGINAL AND INTRA-UTERINE RADIUM THERAPY

Knežević Z., Pujić Z.

Natural-Matematically Sciences Faculty — Sarajevo

In vaginal and intrauterine radium therapy there is an uncertainty as to the exposure of some regions of the rectum and the vesicae urinaria for reasons of anatomic specificities. To ascertain the field of the dose along the rectum in these circumstances we have designed a new type of dosimeter where the scintillating body of the dosimeter is cylindrical and made up of a series of NaJ/Tl/ crystals. They are suitably packed, coated with photomaterial and put into a metal tube for protection against light.

The gauging was made on a standardized Ra-226 source, and the shadowed areas measured on an EEL densitometer, model A. An assessment of the rectal doses can be made as soon as 12 minutes after the commencement of the therapy. Apart from the dose, with this dosimeter one can also identify the most endangered region of the rectum with an error of plus-minus 0,5 cm.

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ISPITIVANJE KARAKTERISTIKA FILM-DOZIMETRA IBK SA KODAK-RM DOZIMETRIJSKIM FILMOM

Prokić M.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Rad obuhvata rezultate ispitivanja karakteristika Kodak-RM dozimetrijskog filma kao elementa film-dozime-

tra namenjenog za merenje integralnih doza od beta i gama zračenja, kao i doza od termalnih neutrona u normalnim i akcidentalnim slučajevima.

Posebno su obrađeni rezultati ispitivanja osetljivosti filma na neutrone i određena je mogućnost merenja integralnih gama doza u polju neutronskog i gama zračenja.

Dobijeni rezultati ukazuju da Kodak-RM dozimetrijski film pokazuje dobre osobine kako za merenje u normalnim, tako i u akcidentalnim situacijama.

SOME PROPERTIES OF THE IBK FILM BADGE WITH KODAK RM DOSIMETRIC FILM

Prokić M.

»Boris Kidrič« Institute of Nuclear Sciences — Vinča

The paper deals with the results obtained in the investigation of the properties of Kodak RM dosimetric film as an element of film-badge used for measuring of integral doses of beta and gamma radiation, as well as thermal neutron doses in normal and accidental cases.

The results of examinations concerning the neutron film sensitivity have particularly been worked out and the possibility of integral gamma doses measurement in the field of neutron and gamma radiation has been estabilished.

The results obtained witness that Kodak RM dosimetric film shows good measuring properties both in normal and accidental cases.

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MERENJE FLUKSA I DOZA BRZIH NEUTRONA POMOĆU SUMPORNOG DETEKTORA

Mirić J., Prokić M., Veličkovć D.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U radu je prikazana metoda određivanja integralnog fluksa i doza brzih neutrona (En 2,9 MeV) pomoću sum-

pornog detektora koji ulazi u sastav akcidentalnog neutronskog dozimetra IBK.

Određeni su uslovi korišćenja detektora i postavljena je metoda merenja aktivnosti za doze više ili niže od 10 rem. Dobijeni rezultati su upoređeni sa rezultatima merenja fluksa pomoću drugih aktivacionih detektora i sa sumpornim detektorom koji izrađuje i baždari Laboratorija IAEA.

DETERMINATION OF FAST NEUTRON FLUX AND DOSES WITH SULPHUR

Mirić J., Prokić M., Veličkovć D.

»Boris Kidrič« Institute of Nuclear Sciences — Vinča

A description is given of the method for fast neutron integral flux and doses measurements by means of sulphur detector, the latter being an element of the IBK accidental neutron dosimeter.

The sulphur detector application conditions have been established as well as measuring methods of its activity for doses higher or lower than 10 rem.

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BAŽDARENJE I PROVERA ISPRAVNOSTI DOZIMETRIJSKE INSTRUMENTACIJE

Mirić P., Bratanić I.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U referatu je data klasifikacija metoda i sredstava za baždarenje i proveru ispravnosti instrumenta za merenje doznih polja i kontaminacije površina.

U vezi sa ovim problemom dat je i kratak prikaz metode i sredstava kojima raspolaže Laboratorija za zaštitu od zračenja Instituta »Boris Kidrič« — Vinča.

CALIBRATION AND ACCURACY CHECK OF DOSIMETRIC INSTRUMENTS

Mirić D., Bratanić J.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča

The paper deals with the classification of methods and means for calibration and check for dose fields and surface contamination instruments measurement.

In connection which this problem, the paper also gives a brief review of methods and means which the Radiation Protection Laboratory of the »Boris Kidrič« Institute at Vinča has at its disposal.

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BROJAČKI KOMPLET STV-1

Vojinović M., Obradović M., Lero N., Frantlović P.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

APSTRAKT NIJE DOSTAVLJEN

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RADIOLOŠKA ZAŠČITA PRI REAKTORJU TRIGA

Gabrovšek Z., Kristan J., Mihelčič B.

Nuklearni institut »Jožef Stefan«, Ljubljana

V referatu je opisan sistem radiološke zaščite pri reaktorju TRIGA Mark II. Poleg vsakodnevnih in tedenskih rutinskih pregledov doz sevanja in kontaminacije površin je glavna naloga radiološke zaščite, da nadzoruje izvajanje varnostnih mer pri delu na eksperimentalnih napravah reaktorja. Opisani so zaščitni ukrepi pri nekaterih tipičnih eksperimentih na reaktorju.

THE RADIATION PROTECTION AT THE NUCLEAR REACTOR TRIGA

Gabrovšek Z., Kristan J., Mihelčič B.

Nuclear Institute »Jožef Stefan« — Ljubljana

In the paper the radiological protection system at the TRIGA Mark II is described. Besides the routine radiological surveys, which are performed on daily or weekly basis, the main task of radiological protection service is to supervise safety measures during the work on experimental facilities. Some typical examples of such work are described.

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MOGUĆNOST PROIZVODNJE PARA RADIOAKTIVNOG JODA-131 U CILJU SIMULIRANJA ATMOSFERE KONTAMINIRANE JODOM-131

Brnović R., Radovanović R., Ranković M.

Institut za medicinu rada i radiološku zaštitu »Dr Dragomir Karajović« — Beograd

U cilju određivanja koncentracije radiojoda-131 u biosferi i radnoj okolini koji se javlja kao posledica različitih akcidentalnih slučajeva, potrebno je izvršiti niz eksperimenata apsorpcije, separacije i kvantitativne identifikacije ovog izotopa u zavisnosti od različitih fizičkih i hemijskih parametara.

Mogućnost da se izvrše navedena ispitivanja pruža nam sistem za proizvodnju para radioaktivnog joda-131 koji je realizovan u toku 1968. god. Funkcionisanje sistema zasnovano je na oslobađanju jodnih para reakcijom oksidacije jodida u jod sa natrijum nitritom u kiseloj sredini. Pare joda se zatim vakuum pumpom povlače u rezervoar u kome se akumuliraju i iz njega se izvode na različite apsorpcione sisteme.

POSSIBILITY OF PRODUCTION OF RADIOACTIVE IODINE-131 VAPOUR IN ORDER TO SIMULATION OF ATMOSPHERE CONTAMINATED BY IODINE-131

Brnović R., Radovanović R., Ranković M.

To determine concentration of radioiodine-131 in biosphere and working environment, who appears as a result of various accidental cases, it is necessary to perform series of experiments of absorption, separation and quantitative identification of this isotope in dependence of various physical and chemcal parameters.

Possibility to be performed aforesaid investigations extends the system for production of radioactive iodine-131 vapours who was realized during 1968. Function of the system is based on liberation of iodine vapour by reaction of oxidation of iodides in iodine with sodium nitrate in an acid medium. Vapours of iodine than by vacuum-pump are drown out in a reservoir where they are accumulated and where from are transported to various absorption systems.

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SORPCIJA NEKIH FISIONIH I AKTIVACIONIH RADIONUKLIDA NA MORSKOM SEDIMENTU

Picer M., Strohal P.

Institut za medicinska istraživanja i medicinu rada, JAZU Zagreb

Farmaceutsko-biokemijski fakultet, Zagreb

U radu su proučavani slijedeći fenomeni vezani uz procese sorpcije radionuklida na krutoj fazi u mediju morske vode:

1. Istražena je kinetika sorpcije ^{144}Ce, ^{106}Ru, ^{65}Zn, ^{58}Co i ^{54}Mn na morskom sedimentu kao i na nekim komponentama morskog sedimenta;

2. Studirane su ravnotežne sorpcione osobine ^{144}Ce, ^{106}Ru, ^{65}Zn, ^{58}Co, ^{54}Mn, ^{137}Cs, ^{125}Sb i ^{85}Sr kod raznih eksperimentalnih uvjeta, te kod raznih fizikalno-kemijskih stanja istraživanih tekućih i krutih faza.

Sumiranjem rezultata istraživanja sorpcije radionuklida na morskom sedimentu dobio se izvjestan poredak nivoa sorpcije prikazan na slijedeći način:

$$Sr^{85} < Sb^{125} \ll Mn^{54} \approx Co^{58} \approx Ru^{106} < Cs^{137} < Zn^{65} < Ce^{144}$$

THE SORPTION OF SOME FISSION AND ACTIVATION RADIONUCLIDES BY THE SEA SEDIMENT

Picer M., Strohal P.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

The following phenomenona related to the process of radionuclide sorption by the solid phase of sea water have been studied:

1. The kinetics of sorption of ^{144}Ce, ^{106}Ru, ^{65}Zn, ^{58}Co, and ^{54}Mn by the sea sediment and by some constituents of the sea sediment, and

2. The counterbalance sorption characteristics of ^{144}Ce, ^{106}Ru, ^{65}Zn, ^{58}Co, ^{54}Mn, ^{137}Cs, ^{85}Sr and Sb^{125} under different experimental conditions and in various physicochemical states of the examined liquid and solid phases.

From the results obtained the following order of sorption levels has been established:

$$Sr^{85} < Sb^{125} \ll Mn^{54} \approx Co^{58} \approx Ru^{106} < Cs^{137} < Zn^{65} < Ce^{144}$$

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DESORPCIJA NEKIH FISIONIH A AKTIVACIONIH RADIONUKLIDA S MORSKOG SEDIMENTA

Picer M., Strohal P.

Institut za medicinska istraživanja i medicinu rada, JAZU Zagreb

Farmaceutsko-biokemijski fakultet, Zagreb

Iz aspekata problema odbacivanja radioaktivnih otpadaka u vodenu sredinu, poznavanje procesa desorpcije ra-

dionuklida sa suspendiranih čestica i sedimenata također je od velikog značaja.

U radu je proučavana desorpcija ^{106}Ru, ^{144}Ce, ^{137}Cs, ^{58}Co, ^{54}Mn, ^{65}Zn s umjetno kontaminiranog vapnenca, dolomita, kvarca i morskog sedimenta tretiranjem krute faze sa sintetskom, prirodnom i ultrafiltriranom morskom vodom· Prilikom tih tretmana upotrebljene su tekuće faze s prirodnim i povišenim koncentracijama vodikovih iona. Na Na te.melju ovih istraživanja dobio se izvjestan poredak sposobnosti desorpcije radionuklida s morskog sedimenta koji se može prikazati na slijedeći način:

$$Zn^{65} \approx Ru^{106} \approx Ce^{144} < Cs^{137} < Co^{58} \ll Mn^{54}$$

DESORPTION OF SOME FISSION AND ACTIVATION RADIONUCLIDES FROM THE SEA SEDIMENT

Picer M., Strohal P.

Institute for Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb
and

Pharmaceutico-Biochemical Faculty, Univerzity of Zagreb, Zagreb

With regard to the problem of radioactive waste disposal into the water medium, the knowledge of the process of radioniclide desorption from suspended particles and sediments is very important. Dosorption of ^{106}Ru, ^{144}Ce, ^{137}Cs, ^{65}Zn, ^{58}Co and ^{54}Mn, from artificialy contaminated limestone, dolomite, quartz and sea sediment samples has been studied by treating the solid phase with synthetic, natural or ultrafiltered sea water. During the treatments liquid phases with natural and ligher concentrations of hydrogen ions were used.

As a result of these studies a certain order of desorption levels of radionuclides has been obtained, which can be represented in the following way:

$$Zn^{65} \approx Ru^{106} \approx Ce^{144} < Cs^{137} < Co^{58} \ll Mn^{54}$$

RADIOPROTEKTIVNA SVOJSTVA NEKIH ORGANSKIH POLIMERA KOJI SLUŽE KAO OMOTAČI ZA PREHRAMBENE PROIZVODE

Stanković S., Veljković S.

INEP — Zemun

U svom radu autori prikazuju adsorptivna svojstva nekih celuloznih i polietilenskih membrana za biološki značajne radionuklide $^{85\ 89}Sr$, ^{137}Cs i ^{144}Cs.

Posebna pažnja posvećena je mogućnosti smanjenja adsorpcije pomenutih radionuklida u uslovima kompleksiranja njihovih jona dinatrijumovom soli EDTA i ostalim organskim kiselinama (benzoevom, limunskom, mlečnom i askorbinskom). Pri adsorpciji jona na membranama koje su impregnirane ovim kompleksnim jedinjenjima, autori su zapazili izvesne pravilnosti koje se mogu objasniti hemijskom prirodom ispitivanih jona.

Zadatak proučavanja i referata je da ukaže na mogućnosti praktične primene rezultata.

RADIOPROTECTIVE CHARACTERISTICS OF CERTAIN ORGANIC POLYMERS WHICH ARE USED AS FOODSTUFF CASINGS

Stanković S., Veljković** S.*

In this work the authors present the adsorptive characteristics of certain cellulose and polyethylene membranes for the biologically significant radionuclides $^{85\ 89}Sr$, ^{137}Cs and ^{144}Cs.

Special attention was given to the possibility of reducing the adsorption of the mentioned radionucleides by

* S. Stanković, Assistant-Master Sc. of Physical Chemistry, INEP, Zemun, Baranjska 15.

** Dr S. Veljković, Professor of Physicl Chemistry, PMF, Studentski trg 16.

complexing their ions with athylendia-minetetra-acetic-acid, and other organic acids (benzoic, citric, lactic and ascorbic).

In the adsorption of ions on membranes which are impregnated by this complex combination — the authors have noticed certain regularities that can bo explained by chemical origin of the examined ions.

The purpose of the studies and of this paper is to point out the possibility of a practical application of the results.

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UTJECAJ ATMOSFERSKIH UVJETA I OKOLINE NA NIVO PRIRODNE BETA RADIOAKTIVNOSTI ATMOSFERE

Popović V., Picer M.

Institut za medicinska istraživanja i medicinu rada JAZU, Zagreb

Radi dobivanja što egzaktnije slike utjecaja atmosferskih uvjeta i okoline na mjerenje i sam nivo prirodne beta radioaktivnsti atmosfere vršena su slijedeća istraživanja:

1. Istražen je utjecaj vlažnosti, temperature i tlaka zraka te je prodiskutiran utjecaj dnevnog temperaturnog gradijenta na nivo radioaktivnosti atmosfere tokom istoga dana.

2. Proučen je utjecaj količine oborina i opće vremenske situacije (vjetar, oblačnost, magla i sl.) na nivo prirodne radioaktivnosti atmosfere kao i njezine varijacije tokom godine.

3. Prodiskutiran je nađeni odnos između zacrnjenosti filtrir papira kroz koji je prosisana izvjesna količina zraka i nivoa radioaktivnosti na njemu reteniranih radionuklida. U vezi toga prodiskutirano je i smanjenje mjerenog nivoa prirodne beta radioaktivnosti atmosfere van gusto naseljenih mesta.

THE INFLUENCE OF METEOROLOGICAL AND ENVIRONMENTAL CONDITIONS UPON THE LEVEL OF NATURAL BETA RADIOACTIVITY IN THE ATMOSPHERE

Popović V., Picer M.

Institute of Medical Research, Yugoslav Academy of Sciences and Arts, Zagreb

To obtain as accurate as possible a picture of the influence of atmospheric conditions and environment upon the measuring procedure and on the level of natural beta radioactivity in the atmosphere the following studies have been carried out:

1. The effect of humidity, temperature and pressure of air was examined and the effect of daily temperature gradient upon the level of atmospheric radioactivity in the course of the same day was discussed.

2. The effect of the amount of atmospheric precipitation and of the general weather situation (windiness, cloudiness, fog, etc.) upon the level of natural radioactivity in the atmosphere as well as upon its variations in the course of a year were studied.

3. The relationship between the degree of density of the filter paper through which a certain quantity of air was pumped and the activity level of radionuclides retained was analyzed. In this connection a lower level of natural beta radioactivity in the atmosphere outside densely populated areas is discussed.

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JAČINA EKSPOZICIONE DOZE PRIRODNG GAMA ZRAČENJA NA TERITORIJI SR SRBIJE

Radovanović R., Hajduković D.

Institut za medicnu rada i radiološku zaštitu »Dr Dragomir Karajović« — Beograd

Na 762 reprezentativne tačke, raspoređene po kvadratima sa ivicom od 15 km, u SR Srbijzi izmerena je jačina

ekspozicione doze prirodnog gama zračenja na visini od 1 m iznad površine zemljišta.

Merenja su vršena uporedo sa vazduhoekvivalentnom jonizacionom komorom, brojačem DT-12 sa plastičnim scintilatorom TPB prečnika 4 cm i dužine 4 cm, ratemeter-om NE-148 sa kristalom NaJ(Tl) prečnika 1,9 cm i dužine 1,9 cm.

Izvestan broj kontrolnih merenja izvešen je gama-spektrometrijskom metodom.

Na kontrolisanim tačkama jačine ekspozicionih doza prirodnog gama zračenja kreću se od 3μr/h do 35μr/h. Na 553 tačke jačina ekspozicione doze je između 5μr/h i 15μr/h, a na 98 tačaka između 15μr/h i 30μr/h. Samo na tri tačke izmerena je jačina ekspozicione doze iznad 30μr/h.

U radu se ukazuje na zavisnost jačine doze od mikrolokacije mernog mesta, geološke strukture terena i sezonskih promena radioaktvnosti prizemnog sloja vazduha.

INTENSITY OF EXPOSURE DOSE OF NATURAL GAMMA-RADIATION ON A TERRITORY OF S. R. SERBIA

Radovanović R., Hajduković D.

Institute of Occupational and Radiological Health
»Dr. Dragomir Karajović« — Beograd

On 762 representative points, distributed into squares with and edge of 15 km, intensity of exposure dose of natural gamma-radiation at the height of 1 m above the ground was measured in S. R. Serbia.

The measurements were perfored parallel by airequivalent ionization chamber, counter DT-12 with a plastic scintilation counter TPB of 4 cm diameter and length of 4 cm, count-ratemeter Ne-148 with crystal NaJ(Tl) of diameter 1,9 cm and height of 1,9 cm.

A certain number of control measurements were done by gamma-spectrometric method.

At the controlled points intensities of exposure doses of natural gamma-radiation are moved from 3μr/h to

35μr/h. In 553 points intensity of exposure dose is between 5μr/h and 15μr/h, and in 98 points between 15μr/h and 30μr/h. Only in 3 points intensity of exposure dose was above 30μr/h.

In the paper it was pointed out to dependence of intensity dose upon microlocation of measuring place, geological structure of a field and seasonal changes of radioactivity of the ground-floor air stratum.

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OLOVO-210, RADIJUM-226 I STRONCIJUM-90 U ŽIVOTINJSKIM KOSTIMA

Moračić Lj., Vukotić M., Brnović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

U ovom radu dat je pregled rezultata merenja koncentracija olova-210, radijuma-226 i stroncijuma-90 u životinjskim kostima. Rađeni su uzorci svih tipova kostiju (vilica, rebro, cevanica, zubi itd.).

Na osnovu podataka o količini ovih radionuklida deponovanih u skeletu računate su doze zračenja koje prima kost. Vršena su upoređivanja veličina doza koje primaju kosti sa prirodnih i veštačkih izvora.

LEAD-210, RADIUM-226 AND STRONTIUM-90 IN ANIMAL BONES

Moračić Lj., Vukotić M., Brnović R.

Institute of Occupational and Radiological Health
»Dr. Dragomir Karajović«, Beograd

In this paper a review of the results of measurements Pb-210, Ra-226 and Sr-90 concentrations in animal bones

are given. The samples of all bone types (jow, rib, shinbone, teeth etc.) were made.

According the data on amount of these radionuclides deposited in skeleton the doses of radiation bone intake were accounted. Amounts of the doses which the bones receive from natural sources were compared with those from artificial sources.

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IDENTIFIKACIJA NEKIH ALKIL-JODIDA U GASNIM EFLUENTIMA METODOM GASNE HROMATOGRAFIJE

Brnović R.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

Jod-131 koji se formira u reaktoru ili nekom drugom nuklearnom sistemu može se osloboditi i kontaminirati okolinu.

Postoji više fizičko-hemijskih oblika u kojima se jod-131 može javiti. Interesantna su organska jedinjenja joda (alkil-jodidi), obzirom na njihovu radiotoksičnost.

U cilju brze i efikasne kvalitativne i kvantitativne identifikacije ovih jedinjenja pokušalo se sa njihovim određivanjem metodom gasne hromatografije. Eksperimenti su vršeni u laboratoriji — Service Technique d'Etudes de Protection-Saclay-France.

IDENTIFICATION OF SOME ALKYL-IODIDES IN GASEOUS EFFLUENTS FROM REACTOR BY A METHOD OF GASEOUS CHROMATOGRAPHY

Brnović R.

Institute of Occupational and Radiological Health
»Dr. Dragomir Karajović« — Beograd

Iodine-131 who is formed in a reactor or in some other nuclear system may be liberated and contamine an environment.

There are several physico-chemical forms where the Iodine-131 may appear. The organic compounds of Iodine (alkyl-iodides) with regard to its radiotoxicity are interesting.

In order to attein fast and efficient qualitative and quantitative identification of these compounds it was tried for its determination by the method of gaseous chromatography. The experiments are carried in the laboratory — Service Technique d'Etudes de Protection — Saclay, France.

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PROTOČNI RADIOMETAR ZA SELEKTIVNU DETEKCIJU BETA-RADIOAKTIVNIH GASOVA U VAZDUHU

Miletić M.

Institut za nuklearne nauke »Boris Kidrič« u Vinči, Beograd

Opisano je jedno novo rešenje uređaja za selektivnu detekciju prisustva beta-radioaktivnih gasova u vazduhu. Uređaj bazira na primeni protočne jonizacione komore a selektivnost detekcije je ostvarena korišćenjem selektivne sorpcije radioaktivnog gasa na specijalnom sorbentu. Specijalni način funkcionisanja aparature omogućuje da se u znatnoj meri eliminišu glavni uzroci grešaka koji inače ograničavaju upotrebljivost protočnih jonizacionih komora: gama-fon, efekat pamćenja itd.

FLOW-TYPE RADIOMETER FOR SELECTIVE DETECTION OF BETA-RADIOACTIVE GASES IN AIR

Miletić M.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča, Beograd

A new device for selective detection of beta-radioactive gases present in air is described. The equipment is

based on the application of a flow-type ionization chamber, while the selectivity of detection is accomplished by using selective sorption of the radioactive gas on a special sorber. A special functional mode of the apparatus enables, to a good extent, the elimination of the main sources of error which, otherwise, limit the possibility of using flow-type ionization chambers: gamma-background, memory effect, etc.

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KONTROLA I ZAŠTITA OD TRICIJUMA

Ninković M.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

U ovom radu su prikazani osnovni vidovi kontrole i detekcije tricijuma u vazduhu. Analizirani su i definisani uslovi koje treba da zadovoljava efikasna aparatura za detekciju tricijuma. Takođe su izloženi rezultati merenja nivoa koncentracije tricijuma iznad slobodne površine tricirane teške vode, sa modifikovanim instrumentom za kontrolu tricijuma komercijalne proizvodnje.

Dat je kratak prikaz osnovnih mogućnosti zaštite od tricijuma — ograničenjem vremena boravka u kontaminiranoj atmosferi i korišćenjem zaštitne opreme. Posebno se ukazuje na činjenicu, da difuzija tricijuma kroz PVC — folije, od kojih se obično prave zaštitna odela, znatno umanjuje njihovu zaštitnu moć.

CONTROL AND PROTECTION AGAINST TRITIUM

Ninković M.

»Boris Kidrič« Institute of Nuclear Sciences, Vinča

The paper deals with basic aspects of the control and detection of tritium in the air. The conditions to be complied by an effective apparatus for tritium detection were analysed and defined. The measurement results of the tritium concentration level above the free surface of tri-

ciated heavy water, with a modified instrument for tritium control of commercial production.

The paper gives the brief review of the principal possibilities of the protection against tritium by limiting the stay time in contamined atmosphere and by using protective equipment. The fact that tritium diffusion through a PVC-foil, used usually for the protection clothes, sonsiderably reduce their protective power, is particularly pointed out.

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MERENJE KONCENTRACIJA RADONOVIH POTOMAKA

Hajduković D.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

Merenja radionovih potomaka vršena su u dva uranska rudnika. Prikazana je metoda uzimanja uzoraka na filtru i merenje — određivanje koncentracije radonovih potomaka. Uporedo su date vrednosti prema američkim autorima kao WL (working level); prema francuskim na osnovu ravnotežnog stanja i računskom metodom na osnovu analize raspadne krive. Prikazane su istovremeno koncentracije radona i gama doze.

THE MEASUREMENT OF RADON-DAUGHTERS CONCENTRATIONS

Hajduković D.

Institute of Occupational and Radiological Health
»Dr. Dragomir Karajović«, Beograd

The measurements of radon-daughters were performed in two uranium mines. The method of sampling on the filter and estimation of radon-daughters concentrations were given. The values were presented comparatively according to the american authors as WL (working level),

according to french based on equillibrium, and to calculation procedure based on analysis of the decay curve. At the same time the radon concentrations and gamma doses were reported·

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MERJENJE RADIOAKTIVNOSTI VODE IN ZRAKA PRI REAKTORJU TRIGA

Kristan J., Gabrovšek Z., Grgič M.

Nuklearni institut »Jožef Stefan«, Ljubljana

Nuklearni reaktor Triga nam kot reaktor z odprtim bazenom nudi edinstveno priliko za studij nastajanja in širjenja radioaktivnih snovi v vodi in zraku v reaktorju in njegovi okolici. Študiran je mehanizem nastajanja in izločanja izotopov Na-24, N-16 in Mg-27 v vodi. V zraku v vseh odprtinah reaktorja na nastaja A-41. Podane so primerjave med izračunanimi in izmerjenimi količinami A-41. Opisana je naprava za umerjanje G. M. cevi za različne koncentracije A-41 v zraku in rezultati meritev pri Trigi.

MEASUREMENTS OF WATER AND AIR RADIOACTIVITY AT NUCLEAR REACTOR TRIGA

Kristan J., Gabrovšek Z., Grgić M.

Nuclear Institute »Jožef Stefan« — Ljubljana

The open pool of the reactor Triga offers the unique possibility to study the production and dispersion of radioactive nuclides in the reactor's water and air and also in the surroundings of the reactor. The study of production and circulation of Na-24, N-16 and Mg-27 is given. A-41 is produced in the air in the all openings of the reactor· The calculated and measured quantities of A-41 are compared. An assembley for G. M. calibration with different concentrations of A-41 in the air and results of A-41 measurements at the Triga reactor are given.

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KONTINUALNO MERENJE RADONA

Hajduković D.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

Metoda je bila primenjena kod inhalacije radonom eksperimentalnih životinja. Ostvaren je protok atmosferskog vazduha bogatog radonom kroz stakleni balon od 0,5 lit sa unutrašnje strane premazan zink sulfidom a merenje je vršeno sa alfa sondom sa fotomultiplikatorom i brojačkom jedinicom.

Efikasnost merenja 60%.

CONTINUAL MEASURING OF RADON

Hajduković D.

Institute of Occupational and Radiological Health
»Dr. Dragomir Karajović«, Beograd

The metod was used at radon inhalation of experimental animals. It was realized a flow of atmospheric air rich of radon through the 0,5 lit glass flaks internally coated with a zinc sulfide phosfor and the measurement was performed by alpha counter with photomultiplier tube and scaler assembly.

The efficience of counting was found 60%.

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RADIOAKTIVNOST RADNE SREDINE U NEURANSKIM RUDNICIMA

Radovanović R., Hajduković D., Vukotić M.

Institut za medicinu rada i radiološku zaštitu
»Dr Dragomir Karajović« — Beograd

U ovom radu dat je pregled rezultata merenja koncentracije radona, jačine ekspozicione doze gama zračenja i

spektri gama zračenja u rudnicima bakra, olova, cinka, feroboksita i žive.

Procenom doza u respiratornom sistemu radnika od inhaliranog radona i njegovih potomaka (100—1000 puta veće koncentracije radona nego u životnoj sredini) ukazuje se na higijenski značaj radijacionih faktora u radnim sredinama ovih rudnika.

RADIOACTIVITY OF A WORKING ENVIRONMENT IN UNURANIUM MINES

Radovanović R., Hajduković D., Vukotić M.

Institute of Occupational and Radiological Health

»Dr. Dragomir Karajović«, Beograd

In this paper a review of the results of radon concentration measurements, intensity of exposure dose of gamma-radiation spectra in the mines of copper, lead, zinc, ferro-bouxite and mercury was given.

By assessment of inhaled radon and its daughters in the respiratory system of the workers (100—1000 times higher concentrations of radon than in life-envirenment) it is pointed to hygienic importance of radioactive factors in a working enviremonet of these mines.

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ISPITIVANJE KARAKTERISTIKA KOMPLEKSNOG SKUPLJAČA JODA NAMENJENOG KONTROLI RADIOAKTIVNE KONTAMINACIJE VAZDUHA

Patić D., Jovanović O., Smiljanić R.

Institut za nuklearne nauke »Boris Kidrič« — Vinča

Napravljen je skupljač tipa »May pack« za uzimanje uzoraka u slučaju kontaminacije atmosfere radioaktivnim jodom. Ispitivane su karakteristike ovoga skupljača na osnovu uzoraka uzetih u prostoriji u kojoj se nalazi ćelija za

proizvodnju joda-131. Merenjem aktivnosti aerosolnog filtra, bakarne žice, ugljem impregniranih filtara i aktivnog uglja od šljivinih koštica, određeno je procentualno učešće pojedinih oblika joda. Raspodela aktivnosti po komponentama skupljača omogućila je da se izvuku izvesni zaključci o osobinama pojedinih komponenata skupljača.

SOME PROPERTIES OF THE IODINE CHARACTERIZATION SAMPLER

Patić D., Jovanović O., Smiljanić R.

Institute of Nuclear Sciences »Boris Kidrič« — Vinča

A »May pack« sampler for separating and measuring the various forms of iodine present in the air is made in the Radiation Protection Laboratory of the »Boris Kidrič« Institute. The samples collected near the iodine-131 production cell are used for the determination of some characteristics of the sampler. By measuring the activity of the particular parts of the sampler (aerosol filter, copper screen, charcoal-impregnated filter papers, granulated activated plum-charcoal) the different forms of iodine-131 are determined.

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